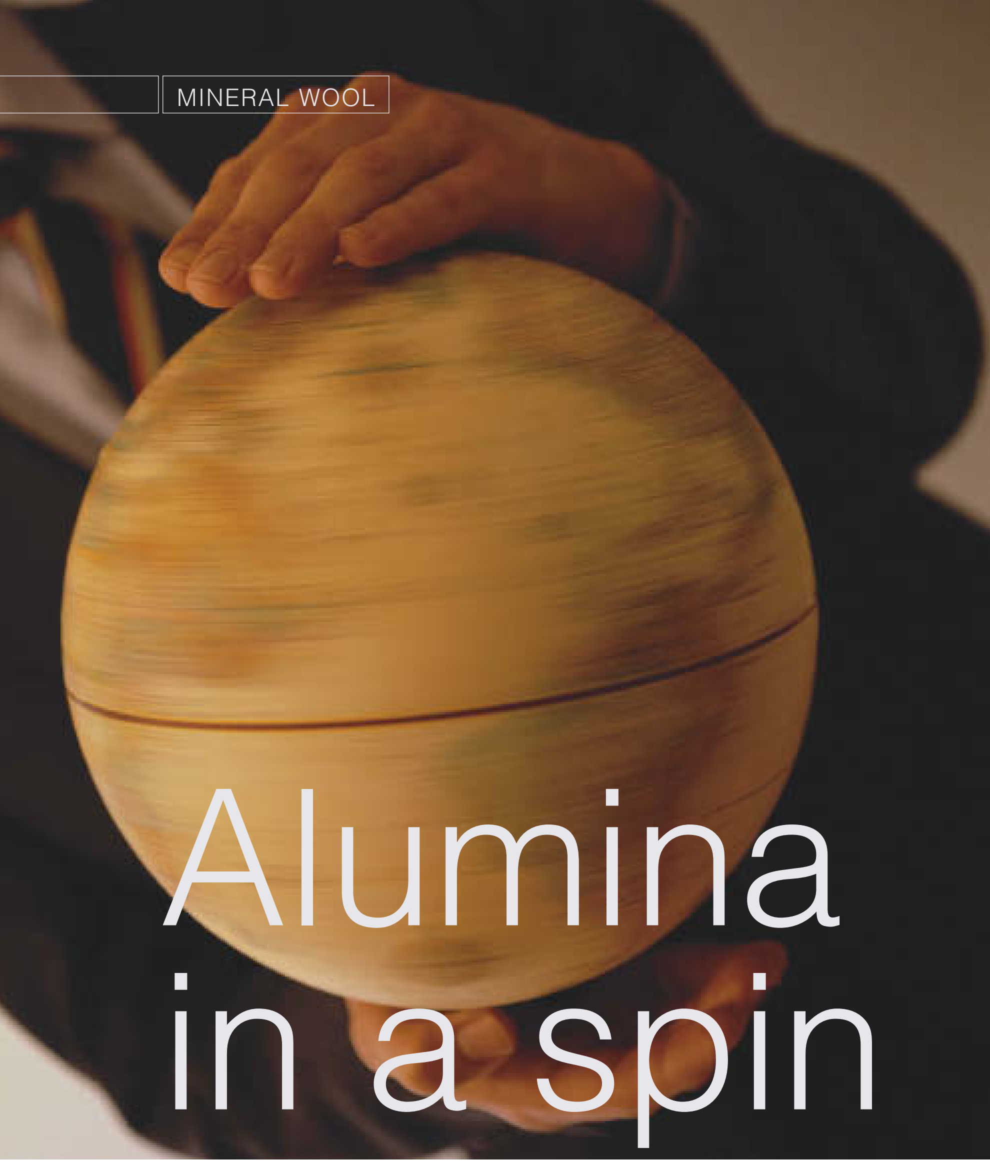
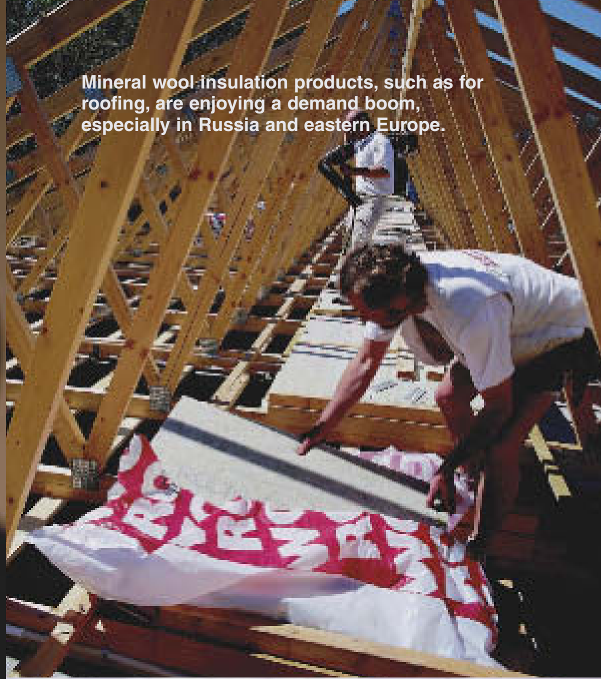
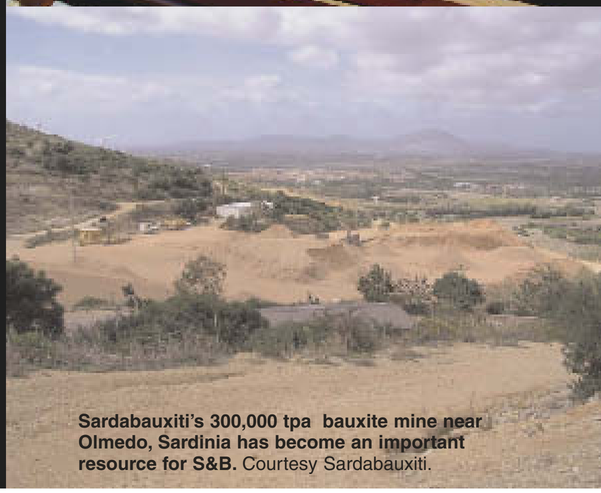


Alumina in a spin



Mineral wool insulation products, such as for roofing, are enjoying a demand boom, especially in Russia and eastern Europe.



Sardabauxiti's 300,000 tpa bauxite mine near Olmedo, Sardinia has become an important resource for S&B. Courtesy Sardabauxiti.

Raw material chemistry is critical in mineral wool manufacture, and therefore careful feedstock selection is paramount. Competition amongst alumina sources is hotting up with potential bauxite alternatives and a buoyant market outlook

by Mike O'Driscoll, *Editor*

MINERAL WOOL HAS a unique range of properties combining high thermal resistance with long term stability that few, if any other insulation materials can match. Mineral wool insulation products play a significant energy conservation role in residential and industrial buildings. Moreover, mineral wool products absorb sound, control condensation, are non-combustible, therefore fire retardant, and do not support the growth of mildew, mould or bacteria.

All in all, with the pressing concerns of global energy conservation, insulation products have an important and prosperous future. This is particularly welcome news for suppliers of raw materials to mineral wool manufacturers ie. basic feedstock rock and sources of alumina. However, changes in raw material requirements, owing to environmental and technical factors, have mineral suppliers keeping a sharp watch on this growing niche sector of the industrial minerals market.

Market growth expected

In December 2005, the EU adopted the new Directive on End-Use Efficiency and Energy Services, which comes into force in 2008. The aim of the directive is to improve end-use energy efficiency in each member state by a minimum of 9% over a period of nine years. This is to be accomplished either through national initiatives and/or through obligations on energy providers to help end-users improve energy efficiency

For any industry active in insulation products, the future certainly appears bright. Mineral wool leader, Rockwool International A/S said of the directive: "The EU Energy Performance of

Woolly terms

There are a number of terms currently used to describe different types of industrial fibre processed from minerals and other materials. The focus of the this article is on fibres produced from natural rock – commonly referred to as *rock wool, stone wool, mineral fibre, or mineral wool*. Here we will use the term *mineral wool*.

There are other forms of "wool" such as *glass wool* (made from sand and cullet) and *slag wool* (made from iron ore blast furnace slag) which are not considered in this article.

The various wools fall within a group of materials historically referred to as man-made vitreous fibres (MMVF), but now known as synthetic vitreous fibres (SVFs) - reflecting the glassy, non-crystalline nature of these materials.

Buildings Directive was implemented in January, and the anticipated increases in energy performance requirements in building regulations are expected to impact the market towards the end of the year."

Indeed, the company reported 2005 sales increases in the UK and France owing to increased insulation thickness requirements. Strong growth in building insulation is expected for the remainder of 2006, and momentum is projected to be driven by the EU directive.

Regionally, it is in central and eastern Europe, and in Russia, where the insulation market is really seeing rapid growth. This is evidenced by the leading mineral wool producers of Europe all vying for production facilities and market share in this region (*see table of producers*). Rockwool reported that its Russian sales had increased from 1% to 6% of the group's turnover in just six years. According to Eurobuild Research, the Russian market for insulation materials has been enjoying double digit growth in the 12-15% range, and will increase to 51m.m^3 in 2010, a massive jump from 23m.m^3 in 2003.

In recent years, mineral wool has held a 75% share of the Russian insulation market, and with reinsulation systems being introduced using mineral wool and plaster, this should be set to continue.

Raw materials & manufacture

The exceptional thermal, fire, and acoustic properties of mineral wool are derived from its chemical composition and from its structure, a mat of fibres which prevent the movement of air. Thus, the raw materials used and the process of manufacture are key to producing successful end products.

In essence, mineral wool is manufactured from melting natural basic rock, with the addition of certain fine tuning materials. The molten material is processed into fibres or wool, which undergoes further treatment, eventually being formed into various finished products of mineral wool, such as rolls, batts, and boards (*see panel for details*).

Successful mineral wool manufacture hinges on the production of a homogeneous melt at minimal cost. Different combinations of raw materials to produce the same mineral wool bulk chemistry can have markedly different energy consumption. Indeed, energy consumption, in the form of foundry coke to fuel the cupola furnace is the single largest production cost for mineral wool manufacturers. To place this in some perspective, Danish mineral wool leader, Rockwool, claims to consume some 20-25% of Europe's volume output of coke each year.

Therefore, mineral wool producers carefully assess the input of all materials. In summary, including alternatives, these are:

Fuel:	foundry grade coke
Primary raw material:	basalt; diabase; gabbro; amphibolite
Flux:	limestone; dolomite; olivine
Alumina source:	bauxite; anorthosite; aluminium salt slag; calcium alumina cement
Cement:	Portland cement

Generally speaking, the primary raw material, usually basalt, accounts for about 98% of mineral wool's components, with the remaining 2% being organic content, generally as a thermosetting resin binder and a little oil. Rockwool consumes about 1.5-2m. tpa of basic raw material for its group plants combined.

But changing technologies in mineral wool manufacture over the years have introduced other materials and size fractions into the process. Perhaps the most important of these has been a source of alumina, mostly as calcined bauxite (*see later*). Other alternatives into the mix also include the use of blast furnace and steel slag.

Another increasing trend has been recycling mineral wool waste back into the mix. Owing to the typical furnace feed of coke and basalt in the form of lumps, say 100-200mm, any recycled material needs to be added in the form of briquettes. The recycled material is crushed to a fine size, about 0-1mm, and briquetted with an alumina source, bound by Portland cement.

Typical desired mineral wool chemical composition for Rockwool ranges 45-48% SiO_2, 18% Al_2O_3, 10% Fe_2O_3, 10% CaO, 10% MgO.

What is clear, is that although a mineral wool producer will strive to produce a standardised grade(s) of mineral wool from each of its plants, the raw material mix from plant to plant may be very different. It is very much a chemical balancing act in dealing with logistically feasible raw materials, and at the right price. Above all, as with most industrial minerals consumers, mineral wool producers want long term consistency of quality and supply.

"Supplier consistency and reliability as well as quality of material are important for the customer choice. Chinese [bauxite], or for that matter any, bauxites for this application are not competitive in distant areas, due to especially high logistics, which cannot be justified at this time." said Dr Yiannis Kontoulis, Head of Business Development, Bauxite Division, S&B Industrial Minerals.

For example, when Rockwool first commenced production at its Bridgend plant in the UK, it was using Swedish rock simply because this was the material used in the initial pioneering production process. Bridgend then migrated to using basalt from Scotland and north-west England, and finally is currently using around 70,000 tpa of basalt sourced from Northern Ireland.

Rockwool's plant in Cigacice, Poland, uses local basalt but imports bauxite from Greece, while its Gogania, plant in Hungary uses local basalt and local bauxite.

David Whyment, corporate raw materials purchaser for Rockwool, told **IM**: "The end product chemistry is set in stone, but the chemistry of raw materials is key, and may differ according to the mix. We may select certain parts of the [basalt] quarry. Proximity and logistics also come into play. In the long term, our aim is to use recycled material as much as possible."

A fine waste process

Mineral wool producer Paroc, in Finland, has developed a process, termed PAROC-WIM, to feed fine fractioned material directly into the mineral wool melt. This is in contrast to the usual process of introducing lump basalt, coke, and waste/bauxite briquettes as mentioned above.

The name of the process comes from Waste Injection into the mineral wool Melting furnace. Paroc reports that optimum environmental benefit of this process is gained when it is used for recycling mineral wool production waste directly into the melting zone. In addition, other fine grain minerals (such as bauxite) and especially fine grain coke can be fed into the melting furnace with WIM.

According to Paroc, the total waste generated in the European mineral wool industry is estimated at 20-60% of product output. This can equate to 160,000-480,000 tonnes of waste in the EU from 40 production lines with an average 20,000 tpa output.

The major source of the waste is the fiberizing process. At the spinning stage, turning molten material into fibre, some 10-20% of the melt is not completely turned into fibre and is consequently rejected from the production process. A mineral wool line at 20,000 tpa generates 2,000-4,000 tpa of fiberizing process waste.

Until recently there has been only one method to re-use this waste; ie. ground and mixed with cement to make briquettes. The briquettes are hardened before use as a raw material in the melting process, acting in the same way as rock.

Disadvantages of briquetting include rather high investment costs in the form of machinery and building, and higher atmospheric emissions of particulate matters and sulphur oxides owing to impurities in cement.

The PAROC-WIM process injects fiberizing process waste, sized 0-6mm, directly into the melting zone within the cupola. The waste is transported to a hopper and a pressurised feeding tank on load cells about 10 metres above. In the bottom of the tank there is a rotating feeder, which feeds small doses of material into three pneumatic feeding pipes. Lances connected to the cupola close to the tuyères are placed at the end of the pipes. The material moves through the lance where oxygen is added into the melting zone in the cupola furnace. The machinery is exposed to an extremely harsh environment. Temperature in the melting zone is above 1,700 °C, at the same time the materials which are fed in are hard and abrasive, which puts a significant strain on the materials and the machinery design.

Other fine grained raw materials and solid fuels can also be injected in the same manner claims Paroc. The PAROC-WIM project has been carried out in two Paroc factories; in Oulu, Finland, and in Hässleholm, Sweden. During 2004, the use of spinning waste recycling has increased from 80% to nearly 100%.

Alumina addition

The addition of alumina into mineral wool manufacture was a direct result of concerns over the bio-solubility of mineral wool, ie. its ability to be dissolved into the human blood system. Basically, it was found that the higher the alumina content of mineral wool, the more easily it was able to dissolve in blood, ie. it has a low bioperstistence. Asbestos has similar morphology, but is more persistent.

The European Commission Directive 97/69/EC of 5 December 1997 excluded certain mineral wools as a potential carcinogen in its direction: "Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+ MgO+BaO) content greater than 18% by weight." Indeed, the International Agency for Research on Cancer (IARC) in October 2001 concluded that mineral wool insulation was "... unclassifiable as to its carcinogenicity to humans".

The upshot is that the raw material mix needs to comprise an appropriate level of alumina. Although this initially burdened mineral wool producers with an additional and sharp increase in raw material costs, it is generally felt that by now producers have been able to accommodate the hit through a combination of skilful blending of materials and plant optimisation. Nevertheless, a source of alumina is now a requirement for mineral wool production.

The choice of primary raw materials and plant process affects the selection of the alumina source. Naturally, any inherent alumina content in the primary raw material potentially saves an additional cost of alumina additives. "The ultimate aim is to use as high alumina content raw materials as possible" said Whyment.

For example, Rockwool plants in the UK tend to use less additional alumina sources than other European plants. This is because the basalt used from Northern Ireland contains a relatively high alumina content (for basalt), around 17.5-18.0% Al_2O_3, as opposed to, say Polish basalt at 12% Al_2O_3.

Overall, Rockwool consumes about 200,000 tpa of alumina containing additive materials. However, there are few sources to choose from, being bauxite, anorthosite, and more recently, aluminium salt slag. Naturally, this has created a competitive market for alumina in mineral wool.

Bauxite

The obvious choice for an alumina source is bauxite. The main sources of choice are calcined Chinese and calcined Greek bauxites. South American and other bauxites appear to have too much moisture and require extra processing. Clearly, chemical composition of the bauxite is important, and especially a low loss on ignition (reduces energy consumption), but so is the grain size.

As mentioned above, mineral wool plants that feed lump coke and basalt, and briquette recycled mineral wool waste, will require bauxite in fine grain fractions (<1mm, but avoiding dust), so that it can be included in the briquetting process.

Incidentally, the former Owens-Corning plant at Queensferry, UK (now part of Knauf) patented the use of lump bauxite in mineral wool manufacture, thus preventing others from using lump bauxite in any case.

Rockwool, having initially started using Chinese bauxite, now tends to favour the use of "southern European" bauxites. These are supplied in <1mm grain size, have 62-63% Al_2O_3, and maybe high in iron, 25-27% Fe_2O_3. Some Chinese bauxite is still used in certain circumstances. "Owing to the cost of Chinese calcined bauxites, significant work was conducted to use other bauxites from Greece, France, Turkey, and Hungary." said Whyment.

Chinese bauxite for the European mineral wool market is supplied by two main players: China Mineral Processing Ltd, in Tanggu, Tianjin, China, and Bosai Minerals Group Co. Ltd, (formerly Nanchuan Minerals), Chongqing, China. For some years, Cofermin Rohstoffe GmbH, Essen, has distributed Bosai's bauxite into Europe, though this may change with the establishment of Bosai Minerals Europe GmbH (*see IM May '06, p.9*) and Cofermin's involvement in promoting aluminium salt slag as an alternative alumina source (*see later*). Bosai supplies about 12,000 tpa for the European mineral wool market.

The overall European market for Chinese bauxite in mineral wool has been estimated at around 30,000 tonnes. The typical specification is for 81% Al_2O_3, <2-3% Fe_2O_3, low LOI, at 95% passing 1mm. However, some -1mm Chinese bauxite becomes quite dusty and has been rejected by certain customers. Chinese grades sold to the mineral wool market are in the range of $75/tonne FOB, although some supplies have been thought to reach as low as $60/tonne.

Of all the "southern European" bauxites, Greek bauxite appears to be the most favoured, although some material also comes from Sardinia. In

Mineral wool production

Raw material input

The required amounts of raw material are measured and sent to a melting furnace, this is the rock (eg. basalt, diabase) and/or recycled material, plus energy, alumina source (calcined bauxite, anorthosite, Al salt slag), (*see text for details*).

Manufacturers are working hard to increase the recycled content of mineral wool whilst maintaining the high quality of their product. The reuse of off-cuts and recycled materials has helped to steadily reduce the energy input required to produce mineral wool.

Furnace

Raw materials are melted in a cupola furnace at very high temperatures, typically 1,300°C to 1,500°C. The smoke that is created during this process is filtered and flue gases cleaned to minimise any environmental impact. Rockwool's Bridgend plant has two parallel production lines each served by its own cupola furnace. The furnaces are fired by coke and oxygen. Gases from the furnaces pass through a large filter and afterburner before being expelled via a chimney.

Spinning

The molten lava from the furnace pours out on to a number of spinning wheels and is thrown by them into the spinning chamber (fiberizing). In the spinning chamber, the droplets of lava cool and solidify into thin woolly strands. Small quantities of resin binder and impregnating oil are simultaneously sprayed into the airflow, forming a fine coating on the fibres. The structure and density of the product can be adapted to its precise final usage. The resulting woolly material gathers on a belt at the far side of the spinning chamber and is laid down on to the production line in the form of a primary mat. Varying the speed of the line as the strands of wool are laid on to it from the spinning chamber can control the thickness of the wool on the production line.

Curing

As the wool moves through the curing oven (at around 200°C), it is compressed by varying the aperture of the oven. This controls the density, and hence the rigidity and structural strength, of the end-product. The curing oven heat-sets the resin binder. The resin binder works by bonding the individual fibres at the intersection where they touch.

Cutting

After the curing oven, facings such as aluminium foil or scrims can be applied to the surface of the stone wool according to product applications and/or customer requirements. The mineral wool is sawn to the required size and shape, for example into rolls, batts, boards or it is customised for addition to other products. Off-cuts and other mineral wool scraps are recycled back into the production process.

Packaging

Owing to its impressive elasticity, mineral wool can be compressed to reduce its volume during packaging, making it cheaper and easier to transport and handle.

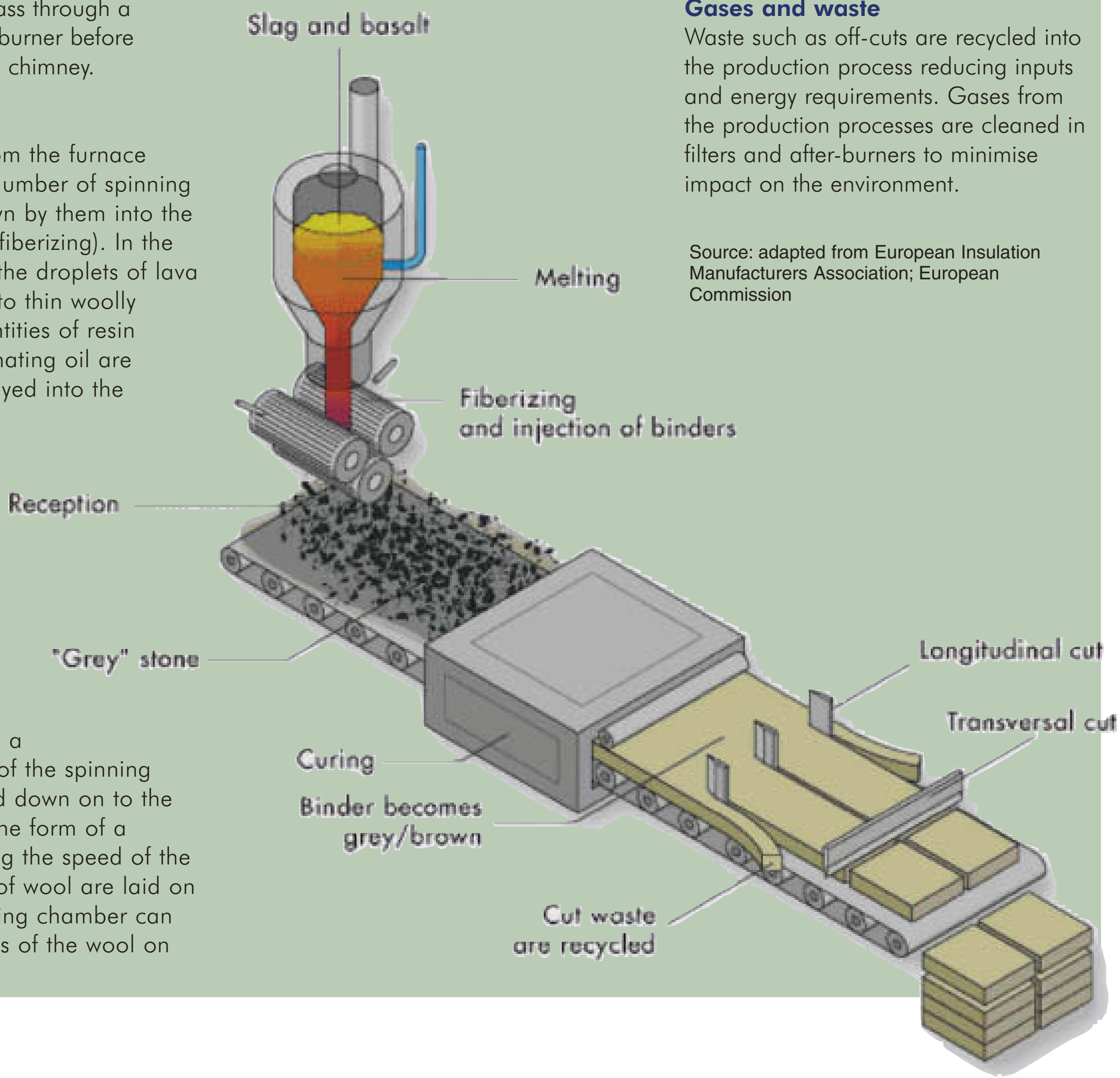
Off-line fabrication

Some mineral wool products, for example pipe sections, are made using off-line processes.

Standard mineral wool slabs may also require additional work, such as rebating the edges or attaching aluminium foil or wire netting. For the fabrication of pipe sections, raw mineral wool is taken from the production lines before it has passed through the curing oven and fed to a free-standing machine that wraps the raw mineral wool round a mandrel. The mineral wool is cured in a small oven whilst still on the pipe section machine and the mandrel is then withdrawn. Some pipe sections are subsequently wrapped in aluminium foil before being packed.

Gases and waste

Waste such as off-cuts are recycled into the production process reducing inputs and energy requirements. Gases from the production processes are cleaned in filters and after-burners to minimise impact on the environment.



Source: adapted from European Insulation Manufacturers Association; European Commission either case, the chief source of this material is S&B Industrial Minerals SA, based in Athens.

S&B's Bauxite Division operates mines at Parnassos, in the Fokis region, with a plant and port facilities at Itea, Fokis. Production capacity is about 1.5m. tpa, which in early 2006 was running near to 100%, according to S&B (*see IM June '06, p.26 for full review of S&B's activities*).

In 2005, S&B bauxite production reached a 10 year high and sales increased by 7.5% to reach €50m. (mainly owing to the Portland cement market), accounting for 15% of S&B's total sales.

S&B bauxite for the mineral wool market is claimed to impart advantageous properties of "lumpy form (when needed), the high tumbling index, and the diversified granulometry." Sales of S&B bauxite into mineral wool in 2005 accounted for 6% of total bauxite sales, remaining at 2004 levels.

In August 2004, an agreement between S&B and Sardabauxiti SpA restarted production at the 300,000 tpa capacity underground Olmedo mine, in Sardinia. Driven initially by demand for metallurgical grade bauxite (probably 60% of production), in return for lending mining, processing, and quality control expertise to Sardabauxiti, S&B has exclusive rights to sell and market the Sardinian bauxite.

At the time, S&B's reasoning for the move was to enhance its bauxite product portfolio – the Sardinian material is boehmitic, with a lower iron content than S&B's Greek diasporic bauxite. That said, various sources have indicated that S&B bauxite output in Greece maybe constrained this year (one estimate suggested by as much as 30-40%) owing to environmental issues. Clearly, the Sardinian source might prove to be a real bonus for S&B.

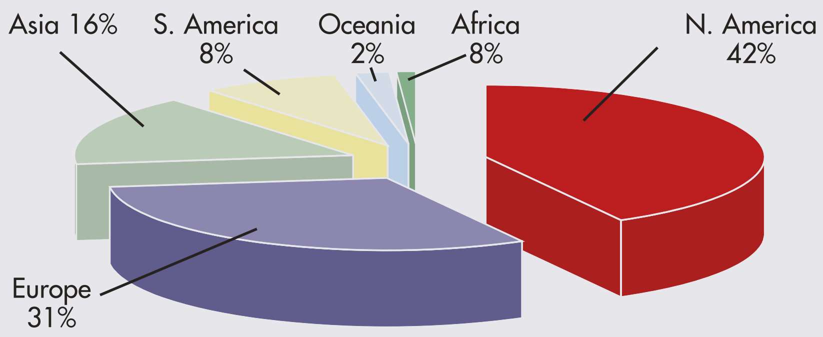
Indeed, in its 2005 Annual Report, S&B regarded the Sardinian agreement as having been "…proven to be of significant importance." The report also stated: "…in 2005 efforts were made in pursuing opportunities for developing new specialized bauxite grades around the globe, suitable for specialty bauxite applications." And with its statement that "the company controls the most significant bauxite reserves in the EU.", perhaps S&B feels it is in a strong position resource-wise regarding bauxite.

Elsewhere, another Greek producer is privately-owned Hellenic Mining Enterprises SA (Elmin), with a 500,000 tpa capacity bauxite operation at Agia Marina in central eastern Greece, close to Stylis port. Most of its production is sold into the aluminium sector. Costas Caralis, commercial director Elmin told IM: "We only occasionally supply the mineral wool market, and have trials underway with Rockwool. Most mineral wool producers require 50 micron to 1mm sizes, but ours are coarser, up to 10mm."

Greek & Sardinian bauxite grades for mineral wool

	Sardabauxiti Sardinia	Elmin Greece	S & B Greece
Al_2O_3%	57-60	60	56-60
SiO_2%	8-12	3	3.5
Fe_2O_3%	8-10	19	22-24
CaO%	1.5	2	1.5-2.0
LOI%	13-15	12	11-12
Grain size (mm)	0-3, 3-20	1-10	0-6m

Accumulation of Al salt slag worldwide 2005, total 4.5m. tpa



Source: Agor AG

Anorthosite

Anorthosite, a plutonic rock composed almost entirely of plagioclase feldspar, is a natural rock source of alumina, and in lump form, for mineral wool production. However, it appears that it is almost exclusively used by Finnish mineral wool producer Paroc Group Oy Ab which operates a captive operation exploiting the Lapinlahti anorthosite deposit (also sold to SP Minerals Oy AB of the Sibleco Group as a source of feldspar).

Paroc has mineral wool plants in Parainen, Oulu, and Lappeenranta which all use this anorthosite. They also use gabbro, amphibolite, and diabase as their basic raw material (and dolomite marble). In 2005, Finland produced 224,000 tonnes of these rocks for mineral wool use, a significant portion of which were exported to Paroc's mineral wool plants around the Baltic Sea. In 2003, Paroc produced 189,000 tonnes of anorthosite.

Anorthositic rocks are also common in several geological provinces in Norway. One of the largest anorthosite complexes in western Europe is situated in western Norway, the Inner Sogn-Voss province, near Gudvangen and Mjølfjell, and stretching from Dyrdal to Kinsedal. The high alumina content, around 31% Al_2O_3, has made this occurrence interesting for various industrial applications, including mineral wool, and also as an alternative raw material for the Norwegian aluminium industry.

Aluminium salt slag

For some years, work as been undertaken in evaluating aluminium salt slag generated as residue from secondary aluminium smelting as a potential source of alumina for a variety of industries, including mineral wool.

When scrap aluminium is remelted, salt is added to the furnace to provide for a working metalllurgical slag and protection from atmospheric oxidation. The resultant waste product is aluminium salt slag, and it is this material which is industrially upgraded into a saleable alumina alternative product.

Clearly, with global emphasis on making the most from industrial waste, and with 0.3 to 0.7 tonne Al salt slag generated with 1 tonne of recycled

European mineral wool producers

Company (& country where headquartered)	Remarks
Rockwool International A/S, Denmark	world leader; 23 plants (20 in Europe, 2 N. America, 1 Asia); opened new 70,000 tpa plant, Vyborg, Russia, June 06; new "high capacity" plant in Croatia planned.
Heraklith AG, Austria	13 plants in Europe; acquired by Knauf Group June 06; in 2005 acquired Eurovek d.o.o., Slovenia, and interests in Termo d.d., Slovenia, Termika d.d., Croatia, and Izomat a.s., Slovakia
Knauf, Germany	4 plants USA; 7 Europe (former Owens-Corning plants acquired 2002)
Saint-Gobain Isover, France	Plants in Australia, Czech Rep., France, Germany, Poland, Spain, Sweden, Turkey; in 2005, Saint-Gobain Isover Austria purchased DBW srl, a leading Romanian producer of rock wool, in Ploiesti.
Paroc Group Oy Ab, Finland	main shareholder Banc of America Equity Partners Europe sold shares to private equity fund Arcapita June 06; plants in Finland (4), Sweden (2), Lithuania, and Poland.
Uralita SA, Spain	in Dec. 02, acquired Pleiderer AG's insulation business, including plants in Germany, Belgium, Poland, Hungary, Slovenia and the Russian Federation.
Flumroc AG, Switzerland	45,000 tpa plant at Flums; licence agreement with Rockwool
Ìzocam Tic. San. AÞ, Turkey	owners Koç Holding AS considering sale – Rockwool and S-G Isover reported to be interested; 25,000 tpa at Gebze plant

aluminium, there is certainly a drive to utilise this potential alumina source. Indeed, some 4.5m. tonnes of Al salt slag accumulates each year on a worldwide basis (see *pie chart*).

Alsa Technologies GmbH (Alsa), in Luenen, Germany has developed Serox, described as "a non-conventional source of alumina for mineral wool production", with plants in Canada and Germany. Alsa is a subsidiary of Agor AG, a Cologne based industrial holding company operating as a partner of the aluminium industry.

Alsa Services Canada Inc. operates two aluminium remelting plants at its wholly owned subsidiary Recyclage d´Aluminium Québec Inc. with a total of three gas-fired rotary drum furnaces. In the two plants, dross mainly from Canadian primary aluminium producers (Bécancour approx. 45,000 tpa, Baie Comeau approx. 25,000 tpa) is processed. Serox production capacity is about 25,000 tpa.

In Germany, Alsa has plants in Hannover and Luenen, and plans to bring on stream a new plant under Alsa Süd GmbH, at Töging by the end of the year. Plant "throughput" for 2006 is estimated at 170,000 tpa for Luenen, 130,000 tpa for Hannover, and 30,000 tpa for Töging (estimated to increase to 100,000 tpa in 2007). Contracts are already in place for its new Bavarian plant that will take total production capacity to 400,000 tpa in 2007. Some 250,000 tpa of Serox will be available from Alsa's European plants.

For 2005, Agor reported that plants operated at full capacity throughout the year and consolidated sales in the Agor Group amounted to €49.7m. (close to 2004's €49.9m.). Agor is looking at potential expansion plants in the USA, and eyeing secondary aluminium producers in Ohio and Tennessee as a guide to possible locations.

Serox contains about 65% Al_2O_3 in its dry state – typical chemical composition of Serox is 63-67% Al_2O_3, 2-4% CaO, 7-14% SiO_2, 4-8 Mg, 1-2% Na_2O+K_2O, 6-12% LOI.

One of the main claimed benefits of using Serox in mineral wool production is its help in saving energy costs by decreasing the sintering and burning temperature. Alsa has been supplying several mineral wool companies in Germany, Denmark, the Netherlands, and Poland with more than 150,000 tpa since 1998.

Depending on the furnaces' total feed mix and the chemical analyses of the desired mineral wool product, the Serox content of briquettes usually ranges between 5-30% by weight, and can go up to 80% if required.

In addition to supplying the market with 0-1mm Chinese bauxite, Cofermin is working closely with Alsa, acting as sales and marketing consultants, and introducing Serox to various industries including mineral wool. Tim Geldmacher, managing partner at Cofermin said: "The reason is simple. While we are supplying Chinese bauxite for this application, we believe that Serox is an excellent raw material with a great future, especially in mineral wool. The future, in our judgement, will belong to Serox rather than any other source of Al_2O_3."

Other Al salt slag players include Kali und Salz AG, Germany (100,000 tpa), BEFESA, Spain and UK (100,000 tpa), RVA, France (75,000 tpa), Alcan, Italy (20,000 tpa), and Alumitech, USA.

However, there are important factors in assessing the use of Al salt slag in mineral wool plants: logistics (proximity of slag upgrading plant to secondary aluminium smelters *and* mineral wool producers); product chemistry (removal of any impurities from the salt slag, compatibility with rest of furnace feed mix); investment in emissions filters upgrade; and finally, price per tonne compared to bauxite.

It is too early to say whether Al salt slag will totally replace bauxite in mineral wool production, but with the increasing drive to use recycled materials perhaps the writing is on certain walls. David Whyment, corporate raw materials purchaser for Rockwool, told IM: "We aim to use dry raw materials that can dissolve in the melt easily. While bauxite supplies have been OK, we intend to maximise our use of recycled materials."

Calcium aluminate cement

Finally, another potential source of alumina for mineral wool production is calcium aluminate cement (CAC), which would also neatly encompass the binding agent, usually Portland cement, used in briquetting the furnace feed.

In mid-2005, Rockwool started construction of a new $92.3m. mineral wool plant on the Istria peninsula in north-west Croatia, the plant design phase is on schedule. The plant location is very favourably close to the CAC plant of Istra Cement d.o.o., at Pula. Perhaps unsurprisingly, Rockwool is to trial the potential use of CAC at its new plant.

Heidelberg Cement AG's 92.4% stake in Istra Cement, through its CAC division Heidelberger Calcium Aluminates (HCA), has recently been sold to Mid Europa Partners, as the German cement producer has divested HCA (*see IM July '06, p.18*)