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NEWS BRIEFS

NEW MODELS OF ELECTROSTATIC SEPARATORS

Outokumpu Technology Inc., Physical Separation Division has announced development of a new line of electrostatic separators *eForce*. These new separators are the result of a combination of the previous concept of high-tension separation with new advances in the electrode design. The company claims that the innovation improved the separation efficiency by 10–15%. The new electrodes can be retrofitted in the existing high-tension machines and the existing set-up in a mineral sands plant has already benefited from this development.

ANOTHER SUPERCONDUCTING CRYOFILTER SHIPPED

Outokumpu Technology, Inc., has shipped the fourth superconducting magnetic separator Cryofilter to IMERYS RCC in Brazil for kaolin beneficiation. It is already the 19th production-scale Cryofilter that has been supplied to the industry. The company announced deliveries of no. 20 Cryofilter to northern Europe and no. 21 to China in 2003.

CARPCO WASH WATER SPIRAL TO BE COMMISSIONED

The first industrial minerals application for the recently developed Carpco wash water spiral is reportedly scheduled for commissioning in the spring of 2003. The new spiral is a seven-turn, wear-resistant polyurethane fibreglass constructed helix designed to separate high concentrations of heavy minerals, requiring supplementary wash water to remove gangue.

LARGE MODULAR JIG INSTALLED

The largest modular Apic jigging plant built so far in South Africa was unveiled by Bateman Titaco and Mintek at the end of 2002. Designed and manufactured by the Bateman–Mintek joint venture, the jig can handle between 100 and 200 t/h of feed. Particle size, typically above 0.5 mm, can go as high as 70 mm. The unit was pre-erected and commissioned at Mintek before being shipped to an overseas client.

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The jig was designed specifically for separating difficult products that require longer residence times – a critical parameter for the efficient stratification and separation of 'near-density' materials. The unit also incorporates the air-distribution and control system developed by Bateman Titaco. Similar features are found on the joint venture's most recent turnkey project, a 160 t/h plant for recovering ferrochromium from slag from slag dump at Middelburg Ferrochrome. Apic jigging plants are currently operating in France, USA, Belgium, Brazil, India, Sweden and South Africa.

MAGIC NUMBERS FOUND TO MAKE 'SUPER-ALLOYS'

A group of 'super-alloys' with properties such as ultra-high strength, super elasticity and super plasticity, has been discovered by researchers at the Toyota Central Research and Development Laboratories and the University of Tokyo. The alloys exhibit their behaviour over a wide range of temperatures, including room temperature.

The researchers found that three electronic 'magic numbers' yield the super-alloys: an electron-to-atom ratio of about 4.24; a bond order, which represents the bonding strength, of 2.87; and d-orbital energy level, which represents the electro negativity, of about 2.45. The 'super' properties arise only when all three numbers are satisfied.

The alloys found in this way are based on titanium, with additional amounts of tantalum, niobium, zirconium, vanadium and oxygen in a simple body-centred cubic structure (T. Saito *et al.* (2003), *Science,* **300**, p. 464).

SUPERCONDUCTIVITY LINKS PHYSICS AND MEDICINE

The 2003 Nobel prizes in physics and physiology or medicine both have connections with the field of particle physics. A. Abrikosov, V. Ginzburg and A. Leggett have received the physics prize for contribution to the theory of superconductors and superfluids, while P. Lauterbur and P. Mansfield were rewarded for discoveries in magnetic resonance imaging (MRI), which is in turn a major use for superconducting magnets.

Abrikosov formulated a theory that explained the behaviour of type-II superconductors, which could not be explained by the earlier BCS theory. In Abrikosov's theory, the external magnetic field penetrates the type-II material through channels between vortices in the 'electron fluid' in the material. This theory was based on work in the 1950s by V. Ginzburg.

Liquid helium, which is used to cool superconducting magnets, becomes superfluid at temperatures below its boiling point and takes on heat transfer properties that allow efficient heat removal over the large distances. Helium-4 becomes superfluid around 2 K, while helium-3 is superfluid only at much lower temperatures of mK range. Leggett developed a theory that explained how helium-3 atoms interact and become ordered in the superfluid state.

Lauterbur discovered, in 1973, how to create 2D pictures of nuclear magnetic resonance signals by introducing gradients in the magnetic field. Mansfield developed

this idea further by showing how the resonance signals could be mathematically analysed to make a useful imaging technique.

THE LARGEST KNELSON GRAVITY CONCENTRATOR

The largest Knelson centrifugal gravity concentrator was unveiled on 17 October 2003, at the Knelson corporate headquarters in Langley. The Knelson KC-XD70 model weighing more than 18 tonnes and being 4 m tall was released at the celebration in honour of Knelson's 25 years of gravity concentration activity. The company is one of the leading players in gravity separation technology, with more than 2500 units installed in 70 countries.

INDUSTRY DELIVERS LHC DIPOLE COILS

By the end of August 2003, 154 dipole coils – representing a whole octant of the CERN's large hadron collider (LHC) – had been produced and approved. The manufacture of the coils, which contain the superconducting cable to provide the all-important 8.33 T magnetic field for the LHC, represents 60% of the magnet production work. The Nb–Ti coils create the magnetic field to guide the two counter-rotating proton beams in separate magnetic channels, but within the same physical structure. The task of building the coils and assembling them into cold masses has been assigned to three firms or consortia – Alstom-Jeumont (France), Ansaldo (Italy) and Noell (Germany). To meet the schedule, each firm will have to produce three cold masses a week from the end of spring 2004 onwards.

OUTOKUMPU AND TATA IN PARTNERSHIP

Outokumpu Technology, Physical Separation Division, signed an agreement with Tata Steel and Iron Company, to conduct a full feasibility study of their mineral sands prospect in the State of Tamil Nadu, India. The project will be completed in two phases. Phase One involves geological exploration, resource evaluation, preparation of mining schemes, metallurgical test work for mineral separation and ilmenite upgrading, financial analysis, and the techno-economic viability of the project.

CARPCO SPIRALS FOR A MEXICAN OPERATION

Two banks of recently re-designed Carpco washwater spirals have been shipped to the Cerro De Mercado Iron Ore Mine in Durango, Mexico. Depending on the grade of the feed material, these spirals will be used either as a second stage for cleaning, or in conjunction with the existing Carpco spirals, as roughers. Ultimately the new spirals will enhance the final grade of the iron concentrate before its shipment to Monclova, where AHMSA will process the concentrate into steel at their blast furnace.

MINERAL DENSITY SEPARATOR PREDICTS PLANT PERFORMANCE

Mintek (South Africa) developed and tested a prototype mineral density separator (MDS) that can be used to characterize ores into different density classes, evaluate and predict dense-media and jigging plant efficiencies, as well as to design and optimize processing plants. The MDS is capable of fractionating ore samples into different density fractions at densities exceeding 4000 kg/m^3. The unit can treat material that falls within the size range 2–30 mm.