COMMINUTION – Professor Klaus Schoenert

In 1955 Hans Rumpf (1911-1976) was appointed Professor of Mechanical Processing Technology at the University of Karlsruhe, Germany, and he established a Fine Particle Research Institute. In 1976, during a lecture to the Fine Particle Society in England, he commented that energy use in comminution could be reduced by up to 90% by crushing single particles instead of materials in bulk. He was succeeded by his student Klaus Schoenert (1927-2011) who continued the institute's research on the breakage of single particles in the 100 µm to 3 mm range. Many pressures were used in tests in the laboratory and briquettes of ne particles were formed which were deglomerated in a ball mill or impact mill. Schoenert showed that high pressure breakage followed by deglomeration required only one third to one half the energy used in a ball mill. The patents which covered his work were for a high pressure comminution process, not a high pressure roller mill by itself. The advance he claimed was for a two step process of stressing a bed above 50 MPa followed by deglomeration. This was challenged in courts in Germany, USA and Denmark but his patents were approved in every case. The high pressure method of breakage and the equipment used are covered by many patents. Some relevant patents are:

• Germany DE 2708053A1 Method for ne and ultra ne grinding of brittle materials 1977

• USA US 3948448 Method for the ne comminution of solid materials with a rolling mill and comminution device for carrying out the method 1976

The high pressure grinding rolls which were part of the patents were licensed to ThyssenKrupp Polysius and KHD for use with cement and minerals. There have been more than 700 installations by Polysius and KHD, and many installations by Koppern and FL Smidth. Its acceptance has veried the claim from the original research that high pressure comminution improved energy e-ciency. The rapid growth in applications for minerals has occurred only during the past 10 years because techniques had to be developed to minimise abrasive wear of the rolls. The year 1986 saw the introduction of hard-faced tyres and then in 2001, the conversion to studs. HPGRs are now an accepted part of comminution technology for minerals as well as cement. So what sparked the research e□ort in the rst place? It was the cement industry, as cement grew rapidly during the 20th century as the material of choice for the construction of buildings and infrastructure. About 100 kWh were required to produce 1 t of nished cement with about 60% being used for grinding, usually in a two compartment ball mill. Following extensive acceptance of HPGR in the cement industry, the list of milestones in HPGR's development in mining is led By De Beers, followed in order by Codelco, Round Mountain (a gold heap leach application), Argyle mine, Cyprus Sierrita, Newmont's Lone Tree, Cerro Verde and Boddington. The rst HPGR in a mining application was a 2.8 m unit in a diamond plant in South Africa. In an application at Argyle Diamond Mine, lamproite was the feed to a machine with a roll diameter of 2,200 mm and roll width of 1,000 mm; motor power two by 1,500 kW. Throughput was 400 to 700 t/h. In these cases HPGR was used as a metallurgical tool. Cyprus Sierrita was the rst application in hard rock (copper ore). The maximum roll diameter was 2.46 m and their width, 1.4 m; motor power two by 2,240 kW. The throughput was up to 1,650 t/h of <50 mm nominal feed material, producing a product of 28-34% <250 µm. Wear protection was provided by stud segments and Ni-hard segments.

The following comments were made on the MEI Blog at the news of the Professor's passing in 2011: Prof. Cyril O'Connor, South Africa: "On the occasion of the sad passing of our dear colleague, Professor Dr Klaus Schoenert, the International Minerals Processing Council wishes to pay tribute to this giant in the world of minerals processing. His many seminal contributions have had a major impact on minerals processing worldwide. The widespread use of the HPGR technology is but one example of the many important contributions he made during his illustrious career. Klaus Schoenert was the recipient of many awards – he was the 2nd recipient of the Lifetime Achievement Award of the IMPC having received this at the XX International

Mineral Processing Congress in Aachen in 1997. He also received the AIME Frank F Aplan award in 1996 in recognition of his ‘unparalleled contributions to fracture phenomena and comminution fundamentals’.” Mike Battersby, Maelgwyn Mineral Services: “I think Klaus Schonert has contributed as much as anyone to advancing our industry and the comminution process. I just wanted to highlight this.”