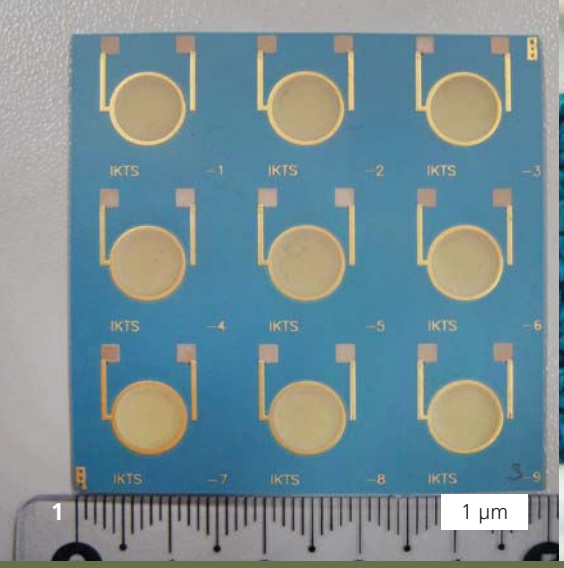

SHOCKWAVE RECYCLING OF CERAMICS AND CERAMIC NOBLE METAL COMPOSITES

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The development of ceramic components and systems is characterized by the increasing integration of components and functionalities. Ceramic materials are applied as substrates, housing or even as independent functional components in the form of electrical conductors, isolators or dielectric components. These components are often firmly bonded with metals or noble metals by coating, brazing and bonding methods, as well as by co-sintering.

Examples for such material composites and composite systems are multilayer components, e.g. fuel cell stacks, sensors and piezoelectric actuators, catalyst substrates or medical devices. The metal bonding partners are often gold, platinum, silver and copper. Frequently, alumina, zirconia and rare earth oxides are used as ceramic materials.

Adensis GmbH developed an innovative material-selective milling technology, whereby an enrichment and recycling of the contained strategic metals, rare earth oxides and noble metals is possible. This technology operates on mechanical shockwaves in fluids for inducing energy coupling and therefore, milling. The shockwaves are produced with the help of the electrohydraulic effect, by which a fluid is ignited between two electrodes in a short-term, intensive electric arc causing an avalanche. In this process, there is no contact with a solid grinding medium, so that separation process can be called contact-free.

Within the framework of the joint research project (grant number 100119802) funded by the Saxon State Ministry of Science and Art, the most important advantage of a material-selective decomposition was emphasized regarding the separation of Low-Temperature Cofired Ceramics (LTCC) and printed gold or silver components as well as the milling of high-quality ceramic components. Economically sensible material systems are LTCC and zirconia ceramics as well as ceramic coatings. On basis of these exemplary systems, the milling and separation efficiency, and its recyclability, i.e. the refeed into the raw-material cycle, was analyzed and evaluated as promising recycling method for the purpose of resource conservation.

1 *LTCC component before (left) and after (right) milling and sorting.*
2 *Milled material of a zirconia monolith.*

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