

Sintering by Activated Surface - A New Method for Cermet Consolidation

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The growing importance and requirements for functional and structural materials has been demanded new processing methods yielding to superior properties. The cermet materials have been considered to fulfil advanced features by combining metals and ceramics characteristics. However, the consolidation processing methods employed - e.g. sintering - are often inadequate insofar as coarsening and losing the desired component function can occur.

Sintering by activated surface (SAS) is a new process route devoted to densify cermets and ceramic materials. The method is integrated once it makes use of designed powder morphologies arising from special thermomechanical treatments: pod-of-pie like. The principles are based on blocking the surface diffusion on ceramic fine particles by plating with metallic layers (micro-plating). Regarding the oxygen potential is controlled to a proper level the metallic layers are swept off at a chosen intermediate temperature in such a way to strongly activate sintering. The particle micro-plating can be carried out by mechanical alloying as well as chemical electroless metal plating methods.

The work shows the first results concerning the development of SAS process on micro-plated powders obtained by the referred methods. The cermets composed of zirconia and alumina ceramics with metallic additives like Ni, Cu, Ag and refractory metals are investigated. The powder morphology and characteristics are analysed by electron microscopy. Sintering kinetics is evaluated to reveal the actual mechanisms, whereas the conventional dilatometry compares the retraction profiles. The sintered microstructures are found to maintain high refinement and dispersion among the phases. The SAS mode can increase the sintered density by 15 %TD or reduce the isotherm final temperature by more than 300°C compared to conventional sintering methods. The method has been considered for solid oxide fuel cell anode preparation, cathodes for high-temperature water vapour electrolysis cathode and catalysis applications.