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Metal-matrix and ceramic composites: from preparation and consolidation to properties

Abstract

In this seminar, metal-matrix (tungsten-based) and ceramic (strontium ferrite-based) composites will be presented. Tungsten-based composites, which will be presented, are candidates for the DEMO divertor. DEMO is a next generation of fusion reactors, which will also be a demonstrational fusion power plant and the divertor is part of the reactor chamber, which has to withstand the highest thermal loads. On the other hand, strontium ferrite-based composites are part of the quest to replace rare-earth magnets in applications, which do not require such high energy products (BH_{max}).

The path will lead us from the preparation of composites, where the major concern is to ensure the homogeneity of the sample while preserving the initial properties of constituent phases. Which approach is better/more appropriate? Should we mix dry powders or should we use solvents or even exploit principles of colloidal chemistry?

Since the majority of applications requires bulk pieces, the next step will be the consolidation of prepared powder mixtures. Sintering is a widely used consolidation technique. However, in the last decade or so, new modifications of this technique, such as Spark Plasma Sintering - SPS (also denoted as Field Assisted Sintering Technique – FAST) are emerging. The comparison of conventional and SPS sintering will be presented in individual cases. The phase composition, microstructure, mechanical and magnetic properties of consolidated samples will be discussed.

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