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Microstructure Modeling and Homogenization Analysis of Porous Ceramics Based on FIB-SEM Images

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This paper discusses the microstructure modeling methodology for porous sprayed coating of Zirconia that has sub-micrometer scaled very complex morphology by FIB(focused ion beam)-SEM technique. Due to its high expenses, only 30 micrometer cubic region was observed, but larger region was requested than at least 100 micrometer for a microstructure model to predict the homogenized properties. Therefore, three types of microscopic elements were carefully observed and their dimensions were statistically measured. They were arranged in 100 micrometer cubic region according to the statistic data. In this microstructure modeling, note that the very fine microscopic element was replaced by the homogenized model. Next, the stochastic homogenization method was applied to the prediction of macroscopic properties. The material property of Zirconia was considered as the random variable assuming the normal distribution in the first-order perturbation based stochastic homogenization method.

Keywords: Porous ceramics, Sprayed coating, Focused ion beam, Homogenization method