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Characteristics of Orientation and Grain-Size Distributions

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We investigate the physical background of Crystal Size Distribution (CSD) and Orientation Distribution Function (ODF) as a useful tool for the analyses of mechanics of polycrystalline materials. The CSD can be used to evaluate the mean grain-size and the ODF gives important information on the degree of anisotropy. Our goal is to show that such distributions have two very important weak points. The CSD provides mean grain-size that depends upon the sensitivity of the microscope. Besides, a random distribution in terms of the ODF does not per se guarantee isotropy. Such shortcomings are overcome when the Theory of Mixtures with Continuous Diversity is applied. It uses in fact the concept of an orientation-and-grain-size mass density and models both, CSD and ODF, such that the cited shortcomings are overcome. Moreover, the evolution equation for the orientation-and-grain-size mass density is automatically given by the balance of mass and one is not forced to provide it in an ad hoc way.

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