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# Numerical investigation of the influence of rolling texture and microstructure on fatigue crack initiation in BCC polycrystals

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**Abstract**

The study aims to investigate the influence of the grain morphology and rolling texture on the fatigue crack initiation in BCC polycrystals. Several 2D polycrystalline aggregates having different grain size and shape distributions are generated based on an anisotropic tessellation and an ellipse packing algorithm. Uniform and typical BCC rolled textures containing both the $\alpha$ and $\gamma$ fibers are considered for the crystallographic texture of the material. Finite element simulations using a crystal plasticity model are performed under cyclic uniaxial tension-compression condition. Twenty simulations are conducted for each type of microstructure in order to obtain significant statistical data. A critical plane fatigue indicator parameter (FIP) following the Tanaka-Mura model is applied to quantify the sensitivity of the microstructure against fatigue crack initiation. The distributions of relevant geometrical, crystallographic and mechanical quantities are analyzed. The effect of the grain size distribution, morphology and texture on the fatigue performance and scattering are discussed.

*Keywords:* Microstructure modeling, Crystal Plasticity, Finite element analysis, Fatigue crack initiation, Fatigue indicator parameter

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