LOCAL FATIGUE CHARACTERISATION OF ARB PROCESSED COPPER SHEETS BY DYNAMIC MICROPILLAR COMPRESSION

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Local fatigue experiments on microscale samples offer the opportunity to isolate microstructural contributions to the mechanical deformation behavior. In contrast to macroscopic fatigue testing, it is therefore possible to independently characterize the effect of individual defects, as for example grain boundaries. In this study accumulative roll bonding (ARB) architectured copper sheets with a bimodal microstructure were analyzed (Figure 1). Micropillars were fabricated by FIB milling inside individual layers of the material. Due to the bimodal microstructure, they exhibit two extremely different grain sizes, which results in a change of the respective fatigue properties. Additionally micropillars were fabricated at the interface in order to study the interfacial contribution to the fatigue behavior. The investigations were performed by a novel approach that combines dynamic nanoindentation and micropillar compression [1]. With this technique the high cycle fatigue range is easily accessible for microscale samples. Observation of the underlying deformation processes was performed by recording SEM micrographs of the deformed samples. FIB cross-sectioning of the deformed samples was used to investigate the deformed microstructure in the bulk of the specimens.

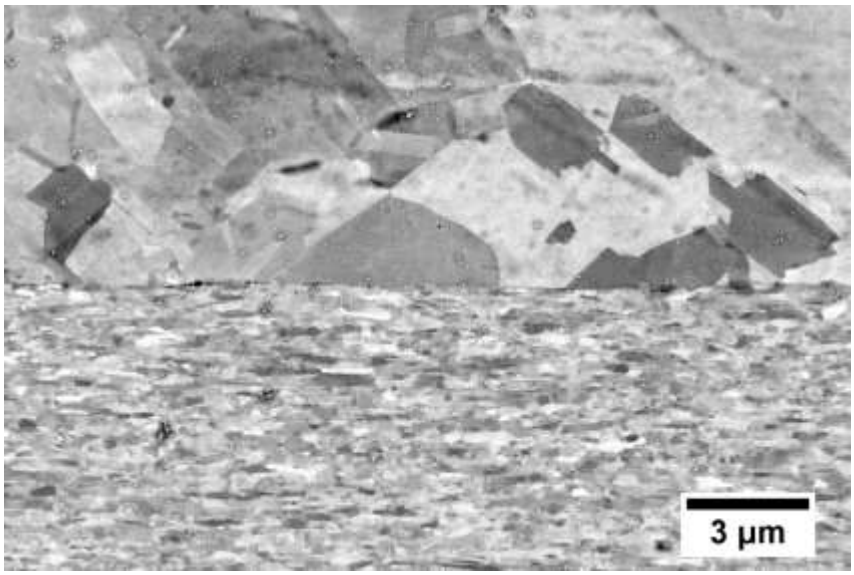

Figure 1 – Bimodal microstructure of the ARB processed copper sheets

[1] Merle, B., Höppel, H.W. Microscale High-Cycle Fatigue Testing by Dynamic Micropillar Compression Using Continuous Stiffness Measurement. (2018) Experimental Mechanics, 58(3), pp. 465-474