Effect of annealing temperature on microstructure and mechanical properties of ultrafine grained brass produced by equal channel angular pressing

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The present study investigated the mechanical properties and microstructure of ultrafine grained (UFG) brass processed by four passes of equal channel angular pressing (ECAP) and annealed at elevated temperatures. The mechanical properties of all samples were assessed using tensile and micro-hardness tests. Microstructure analysis was performed using optical microscopy (OM) and scanning electron microscopy (SEM). Ultimate tensile strengths (UTS) and yield strengths (YS) of 878 and 804 MPa, respectively, ductility of 15%, and hardness of 248 HV were obtained for samples processed by four passes of ECAP with equivalent true strain of 4.20. Annealing at 300°C caused UTS and YS to decrease significantly, to 510 and 408 MPa, respectively, ductility to increase to 28%, and hardness to decrease to 165 HV. Fractography analysis of un-annealed samples after four ECAP passes showed small brittle fractures with shallow dimpling. Ductile failures were found on annealed samples. After four ECAP passes, the microstructure of un-annealed samples was UFG and dominated by lamellar grain with shear band. In contrast, after annealing, the microstructure changed due to recrystallization, showing nucleation and grain growth.