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Machinability analysis of an Al-8.0 wt.%Cu alloy by joint evaluation of three criteria

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Traditionally, mapping the machining conditions has been an object of study once it has a pivotal role in optimizing manufacturing processes. For each tool-part to be efficient regarding cutting processes and surface quality life of the machined part, some parameters were standardized, varying the others. Recent studies in manufacturing properties have heightened the need to directly relate the morphology of the microstructure and solidification process of the alloys, thus being able to associate microstructural characteristics with the machinability of a material. It is still needed quantitative investigations to establish a database that indicates, for each type of alloy, the best solidification conditions that lead to better machinability rates. Taking this as a basis, this type of study was established in an alloy of the 2xx.x series, as it has wide application in the industrial area, with emphasis on the aerospace and automotive sectors, which have the machining processes inserted in their production chains. For this, necking tests were performed in a semi-automatic bench lathe, using HSS T6 high-speed steel tools, and cutting temperature, tool wear, and surface roughness were analyzed. One interesting finding is that the shear heating rate increases with increasing secondary dendritic spacing and decreases with increasing cooling rate, the same behavior found for surface roughness, but different from the ones found for tool wear. The results could be mathematically expressed by power-type functions, with a good correlation coefficient.