Effects of Machining on the Quality of A390 Aluminum-matrix Composites

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ABSTRACT

The aims of this study are to investigate the effects of machining on the quality of A390 aluminum-matrix composites by Taguchi method. The A390.1 aluminum alloy is chosen as the basic material of the composite, and the silicon carbide (SiCp) with 325-mesh size number is taken as the reinforcement materials of the composite. The composite is also heat-treated by the T6 precipitation hardening heat treatment in order to be machined and compared with the as-cast condition. In cooperation with Taguchi L9 orthogonal arrays, the machining parameters such as tool material, cutting speed, feed, and depth of cut were designed to evaluate the effects on the cutting force, the tool wear and surface roughness. The cutting tools like TiC and CBN materials were also used to cut the A390/SiCp composite and to understand the machinability of TiC and CBN tools on the composite, since the TiC and CBN tools are cheaper then the PCD tool. In addition, the machining mechanism is built up by ways of the observation for the microstructure in shear zone, the combination of SiCp and aluminum matrix and the reaction compounds. The results of research show that the machining mechanism of cutting A390/SiCp composite is more complicated than that of cutting brittle materials. This composite can acquire the better surface smoothness after T6 heat-treated. On the evaluation of choosing cutting tools, the CBN tool can reveal the lower flank wear and the better surface smoothness. On the other hand, built-up edge (BUE) produced on the process of cutting will be useful for machining the A390/SiCp composites

Keywords : AMC/SiCp, Machining, Roughness, Heat treatment, Taguchi method, A390 alloy

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