**Abstract:**

Friction stir processing is a new method invented for preparation of surface composites and modifies the microstructure in most of the aluminum alloys. AA6061 is widely used in aerospace applications and industries. In the present work, the influence of multi-pass and under water cooling FSP on grain size and mechanical properties of AA6061 alloy were studied. Process parameters were optimized from the trial experiments. The macrostructural analysis was carried out and it was observed that fine grains were produced in third-pass as compared to the other two passes. So, three-pass FSP was conducted in ambient conditions i.e at room temperature and in the water environment. The tensile test was carried out to find the ultimate tensile strength of FSP 3-pass sample. Micro-hardness values are found using a Vicker's hardness test. Underwater friction stir processing resulted in better mechanical properties compare to air cooling.