Co-extrusion of a Mg/Al Composite Billet: A Computational Study Validated by Experiments

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ABSTRACT:

Magnesium alloys, although possessing a high strength to weight ratio, have low corrosion resistance which limits their application as structural materials in the aerospace and automobile industry [1]. One possibility of overcoming this limitation is to use composite Mg/Al engineering components in which the aluminum is used as an outer shell which provides the component with good corrosion resistance while maintaining a better strength to weight ratio compared to similar sized aluminum components [2].

In this study, the process of hot co-extrusion of a composite Mg/Al rod was investigated by a coupled thermo-mechanical finite element analysis in conjunction with hot co-extrusion experiments. Following convergence tests for solution verification, model validation was conducted by comparing both computed and experimental force-displacement curves as well as computed and experimental inner magnesium core dimensions measured using radiography and metallography. The FE model was also used to investigate the effect of the initial billet temperature, ram speed, die angle and extrusion ratio on the resulting composite rod. The study demonstrates that proportional material flow resulting in an almost uniform aluminum outer shell can be obtained by using a novel composite billet configuration, limiting the thermal gradients between billet and tools and employing low ram velocities [3].

REFERENCES:

