A COMPARISON OF DEFORMED IRON-CARBON ALLOY POWDER PREFORMS WITH COMMERCIAL IRON-CARBON ALLOYS

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INTRODUCTION

The mechanical properties of fully densified hot-formed atomized iron preforms are equivalent or superior to commercial irons.[1] Impact transition temperatures are identical (∿-50°C) for both powder formed and conventional irons; however, shelf energy is greater for powder formed material (>200 ft.lbs. vs. 150 ft.-lbs.).

Tensile properties of hot formed atomized iron preforms containing 0.4% carbon are equivalent to conventional AISI 1040 wrought steel properties.[2] However, room temperature impact properties of powder formed material are significantly less than those of AISI 1040 wrought steel. Room temperature Charpy "V" notch impact strength in a quenched and tempered condition for powder-formed material is about one half value for conventional wrought AISI 1040 steel.

The cause of the relative drastic reduction in impact properties of powder formed iron with carbon present was revealed by microstructural analysis. A continuous carbide network surrounded ferrite grains in the slack-quenched powder formed material. Studies of fracture path revealed it followed the carbide network.

It has been determined that sintered iron-carbon preforms can be fully densified by cold forming:[3] however, mechanical properties of cold formed material were not established - therefore, the object of this study was to determine mechanical properties of cold formed Fe-C alloy preforms compared to commercial steels; also to determine if embrittlement similar to that observed by hot forming occurs in cold formed material.