

## IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)

Advancements in Materials Applications, Additive Manufacturing, and Rapid Prototyping Manufacturing  
and Rapid Prototyping (8)

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PRACTICAL INVESTIGATION INTO THE DIFFUSION BONDING OF 316L STAINLESS STEEL  
WITH BORON CARBIDE FOR RADIATION SHIELDING IN NUCLEAR THERMAL PROPULSION  
APPLICATION

**Abstract**

Diffusion Bonding is a solid-state welding process in which two or more materials are bonded together into one seamless structure under high temperature, vacuum, and pressure conditions without requiring any external fixations. This process allows for the creation of complex structures impregnated with substances that possess qualities comparable to their base components, while at the same time, producing negligible adverse effects on the final product's material properties. Design limitations in radiation shielding for spacecraft commonly require the structures to possess low weight and exceptional material properties when produced. A successful bond between 316L stainless steel and boron carbide would reduce shielding weight by removing requirements for external fixations and produce a material that is potentially capable of acting as a structurally sound wall for habitation. This investigation evaluated the interdiffusion regions in and around the bond of 316L stainless steel with boron carbide while supporting and validating the creation of the first physically bonded sample between the two materials. This research assists and grows the current work put into Diffusion Bonding as an additive manufacturing technique, strengthening its use in aerospace, nuclear, and manufacturing applications.