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CONTINUOUS SPRAY FORMING OF FUNCTIONAL GRADIENT MATERIALS

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Plasma Processes Inc. has produced a Functional Gradient Material (FGM) through advanced vacuum plasma spray processing for high temperature structural applications. A FGM is a composite that smoothly transitions from one material at one surface to another material at the opposite surface. Outlined in this paper are the manufacturing methods PPI used to develop a four component functional gradient material of copper, tungsten, boron, and boron nitride. The FGM was formed with continuous gradients and integral cooling channels eliminating bond lines and providing direct heat transfer from the high temperature exposed surface to a cooling medium. Metallurgical and X-ray diffraction analyses of the materials formed through innovative VPS processing are also presented. Applications for this functional gradient structural material range from fusion reactors to missile nose cones to boilers. Current PPI FGM research includes the VPS forming of copper/ aluminum/ beryllium functional gradient materials for fusion reactor applications.