REACTIVE OXIDE BRAZE JOINING OF CERAMIC TUBES WITH A HIGH-POWER 83-GHZ MILLIMETER-WAVE BEAM SYSTEM*

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High power beams that can be generated by CW gyrotrons represent a promising energy source for high-temperature processing of materials. They provide efficient coupling to low loss ceramic materials and allow controlled, localized deposition of energy. The latter has some significant advantages by permitting extensive use of instrumentation for process control and use of base metal fixturing for processing. The last is particularly important in joining of high temperature ceramics since provisions for alignment of components being joined and application of pressure to joints is frequently required. An experimental facility based on an 83-GHz, 15 kW CW industrial gyrotron has been set up at the Naval Research Laboratory to investigate various novel mm-wave-beam-based approaches to processing of ceramic materials including sintering, coating, and joining applications as described here. We are currently pursuing both experimental and theoretical investigations of the formation of strong bonds between ceramics and between ceramics and metals using controlled, selective heating of the joint area with the 83 GHz beam system. In this paper, the results of current joining experiments will be described. In particular, the results from the joining of ceramic tubes for a dielectric-loaded accelerator[1] will be presented. Additionally, we will discuss novel methods for temperature sensing as well as visual monitoring of the ongoing joining process.

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*Supported by a Department of Energy SBIR and by the Office of Naval Research

1) S.H. Gold, A.K. Kinkead, W. Gai, R. Konecny, C. Jing, W. Liu, J.G. Power, and Z.M. Yusof, *High-Power Tests of X-Band Dielectric-Loaded Accelerating Structures,* in High Energy Density and High Power RF, S.H. Gold and G.S. Nusinovich, Eds., AIP Conference Proceedings 691, June 2003, Melville, NY.