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Review on joining of advanced materials and dissimilar materials in Harbin Institute of Technology

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ABSTRACT

Ceramics and ceramics, composites and composites, ceramics and metals, and composites and metals together with metals and metals could be successfully joined by brazing, soldering, and diffusion bonding. Joints microstructure was investigated by scanning electron microscope (SEM), transmission electron microscope (TEM), and energy dispersive spectrometer (EDS). Interfacial reactions and joining mechanism were analyzed, and joining parameters were optimized by joining process testing. The mechanical properties of the joints were measured by mechanical testing machine. Results indicate that *in situ* synthesized reinforcements could adjust the mismatch of CTE between ceramics and metals to decrease the residual thermal stress of ceramic-metal joints and improve the joint shear strength. Meanwhile, CNTs and $9Al_2O_3{\cdot}2B_2O_3$ were added into Sn–58Bi solder by either ball milling and low temperature melting process or mechanical mixing method, which was better than Sn–58Bi matrix owing to reduce of Sn-rich segregation and the grain refinement. Furthermore, both the addition of CNTs and the whiskers could improve the wettability of the composite solder. Diffusion bonding was successfully used to join titanium and hydrogenated titanium alloys. The increasing soft bH phase enhanced the local plastic deformation of hydrogenated titanium alloys, and the voids disappeared at the diffusion bonding interface. Together with the dehydrogenation reaction heightened the element diffusion and the surface activity, which led to the acceleration of the diffusion bonding process.

KEYWORDS: brazing, soldering, diffusion bonding