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## **Qualification of Electron-Beam Welded Joints between Copper and Stainless Steel for Cryogenic Application**

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Joints between copper and stainless steel are commonly applied in cryogenic systems. A relatively new and increasingly important method to combine these materials is electron-beam (EB) welding. Typically, welds in cryogenic applications need to withstand a temperature range from 300 K down to 4 K and pressures of several MPa. However, very little data is available for classifying EB welds between OFH copper and 316L stainless steel.

Therefore, a broad test program has been conducted in order to qualify this kind of weld. The experiments started with destructive tensile tests at room temperature, at liquid nitrogen and at liquid helium temperatures, yielding information on the yield strength and the tensile strength of the welds at these temperatures. The tests were followed by nondestructive tensile tests up to yield strength, i.e. the range in which the weld can be stressed during the operation. To verify the leak-tightness of the joints, integral leak tests at operating pressures of 5 MPa were carried out before and after each tensile test, each at room- and at liquid nitrogen temperature. Finally, the hardness of the EB weld was measured in the weld area. The results of the qualification indicate that EB welded joints between OFH copper and 316L stainless steel are reliable and present an interesting alternative to other technologies such as brazing or friction welding.

**Primary author:** LUSCH, Christoph (KIT, Institute for Technical Physics)

**Co-authors:** HEIDT, Carolin (KIT, Institute for Technical Physics); Dr SAS, Jan (KIT, Institute for Technical Physics); Dr WEISS, Klaus-Peter (KIT, Institute for Technical Physics); Prof. GROHMANN, Steffen (KIT, Institute for Technical Physics)

**Presenter:** Dr WEISS, Klaus-Peter (KIT, Institute for Technical Physics)

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