A.10: Study on brazing of GLIDCOP® to OFE copper for Indus-2 photon absorber

In 2.5 GeV Indus-2 storage ring, only 15% of emitted synchrotron radiation (SR) power is channelled in beam lines while the rest is absorbed by water-cooled photon absorbers. In the upgraded design of photon absorber, the bottom part, facing SR, is made of GLIDCOP® (an oxide dispersion strengthened copper) having high strength at elevated temperature as well as in radiation environment. The intermediate part is made of OFE copper which is to be joined to this bottom part. The dissimilar joint between GLIDCOP® to OFE copper is required to be hermetically sealed (He leak rate < 2 x 10^{-10} mbar.lit/s), bakeable upto 150°C and reasonably strong to withstand high water pressure. Present study was undertaken to evaluate GLIDCOP® /OFE copper brazing process in hydrogen furnace using 50Au/50Cu brazing alloy.

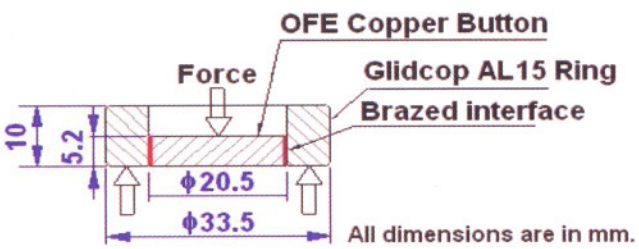

Fig. A.10.1: Details of the specimen used for the study.

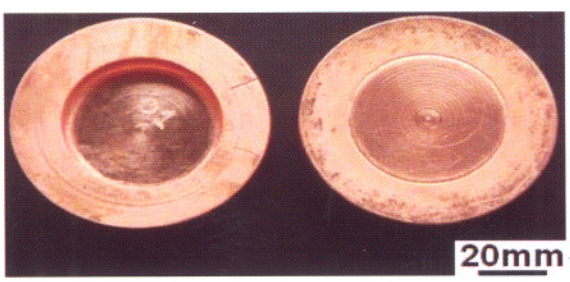

Fig. A.10.2: As-brazed specimens.

Table A.10.1: Brazing parameters

Furnace atmosphere	Brazing cycle
High purity hydrogen - IOLAR Grade1 (99.9995%) Hydrogen flow rate: 50 std. ft3/hr Dew point: -50°C	RT -600 °C @ 10 °C/min Soaking for 30 mins. 600- 950 °C @ 10 °C/min Soaking for 30 mins. 950-1020 °C @ 2 °C/min Soaking for 3 mins. Furnace switched off and job shifted to cool zone (<300°C) till temperature drops to 40 °C.

The study involved brazing of GLIDCOP® ring to OFE copper button (Figs. A.10.1 and A.10.2) and brazing parameters are shown in Table A.10.1. Helium leak testing of the brazed specimens exhibited a leak rate less that 2 x 10^{-10} mbar.lit/s. Leak tightness of the brazed joint remained intact after undergoing 6 numbers of thermal cycles, each involving heating to 150 °C, soaking for 8 hrs, followed by cooling to room temperature (RT). This ensured bakeability of the brazed joint for UHV application. The brazed specimen exhibited full penetration of the brazing alloy (refer Figs. A.10.2 and A.10.3). Although it had some isolated pinhole porosities (Fig. A.10.4), the brazed joint was found to be good. Shear strength of the brazed joint (refer Fig. A.10.1) was 163 MPa and failure of the specimen took place within the brazed alloy (Fig. A.10.5), indicating that the two associated interfaces (GLIDCOP®/brazing alloy and OFE copper/brazing alloy) were stronger than the brazing alloy. This study paved the way for brazing of upgraded photon absorbers for Indus-2.

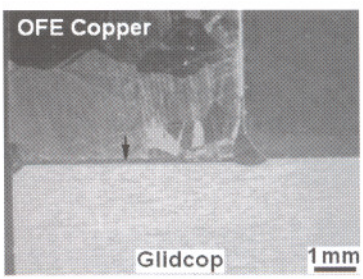

Fig. A.10.3: Cross-section of the brazed specimen. Brazed joint is marked with arrow.

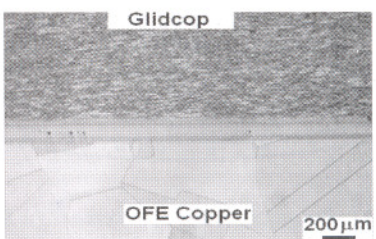

Fig. A.10.4: Magnified view of the brazed interface.

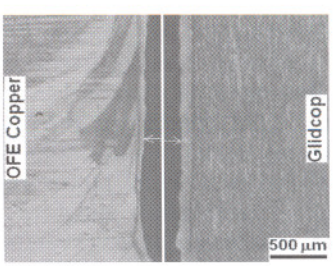

Fig. A.10.5: Cross-section of shear tested specimen. Arrows mark brazing alloy on the sheared surfaces.

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