§46. Evaluations of Thermal Shock Properties for the Joint Material Between Carbon/Carbon Composite and Oxygen-free Copper

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The materials used were a carbon-carbon composite (CX-2002U), the rayon felt based carbon composite manufactured by chemical vapor infiltration treatment, and a joint, CX-2002U/Cu (oxygen-free copper). The joint was made using silver solder (BAg-3) at 690-815℃. In order to reduce the difference of the thermal expansion between carbon and copper , seven layers that consist of copper , steel, copper films, molybdenum sheet, cooper, steel and silver films were placed between carbon and copper blocks.

The thermal shock properties and thermal shock toughness were evaluated[1] using disc type specimen by eccentrically local arc heating method.

The fracture of CX-2002U/Cu was not seen even at 400 MW/m^2, although CX-2002U itself fractured at about 160 MW/m^2. The values of thermal shock toughness for CX-2002U/Cu was 3.5 times as large as those for CX-2002U.

Fig.1 shows microphotograph of the joint by SEM after thermal shock test. A crack by thermal stress was seen from the mixed layer of copper with CX-2002U to copper film neighbor to molybdenum sheet. Furthermore, an exfoliation was seen on the interface between copper film and molybdenum sheet. However, large through-cracks by thermal stress have never seen in CX-2002U and molybdenum layer.

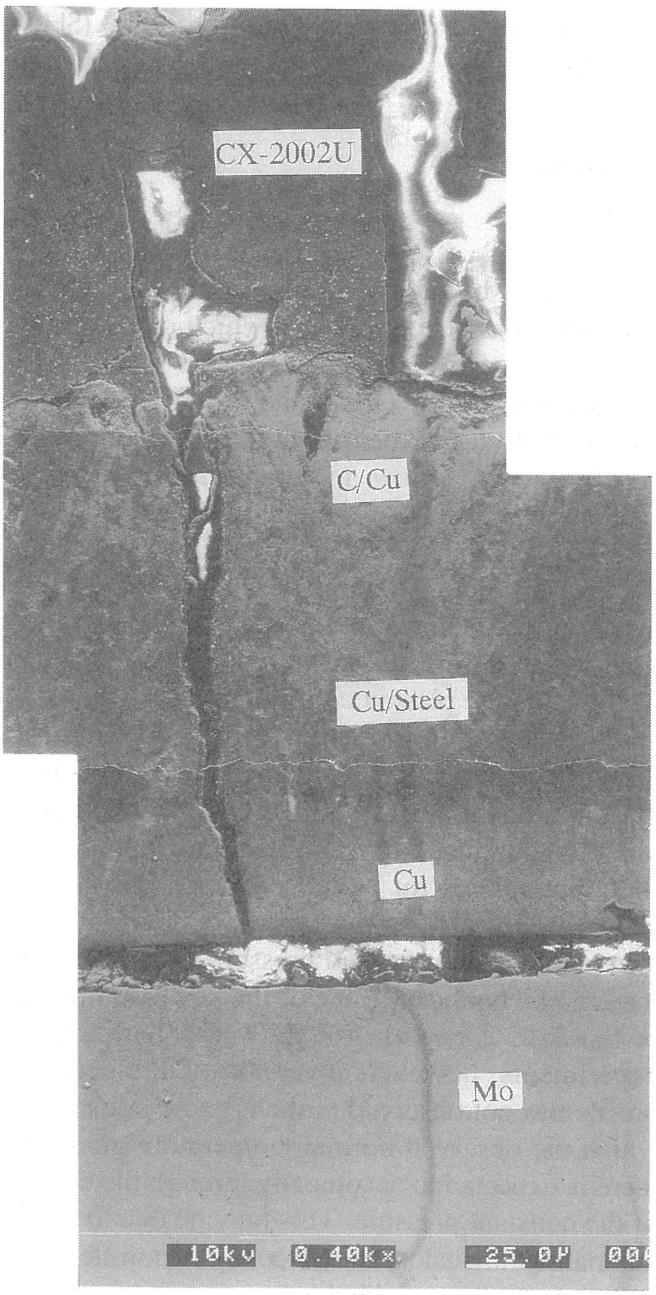

Fig.1 Micro structure of CX-2002U/Cu joint after thermal shock test.

References

1) Sato, S., et al., Carbon, 16(1978)103.