# Thermal Stress Analysis and Brazing Test for Design of a Frontend Pulse-by-pulse SR Beam Monitor

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We have developed a frontend pulse-by-pulse synchrotron radiation (SR) beam monitor operated in photoemission mode. A microstripline structure has been adopted for a detector head in order to improve RF property. The detector head must be also designed to have high heat proof property, so we have carried out thermal stress analyses and brazing tests of the materials.

An important point for design of frontend components is consideration about high heat proof against extremely high power SR, especially in the third generation SR facilities, such as SPring-8. The frontend pulse-by-pulse SR beam monitor has the following mechanical structures for improving thermal properties, as shown in Fig. 1. The detector head of the monitor has a metal line brazed to dielectric plates. The plates are connected to a metal cooling base by brazing. We chose aluminum nitride (AlN) for the dielectric plates, because AlN has the high heat conductivity (150 W/m·K). We chose copper tungsten (Cu10-W90) for the cooling base, because Cu10-W90 has the high heat conductivity (180 W/m·K). The small thermal expansion coefficient of Cu10-W90 ($6.5\times10^{-6}$/K) is important for connecting a ceramics, such as AlN ($4.6\times10^{-6}$/K).

We have simulated residual stress of AlN plates after brazing on CuW cooling blocks. Maximum and minimum principal stresses of various sizes of the plates were examined. Silicon carbide (SiC) has been also simulated. SiC is another candidate for the dielectric plate. SiC can reduce electrification on the surface of the detector head because of the low electric resistivity. Brazing tests have been carried out for both AlN/CuW and SiC/CuW brazing. We will report on details of thermal stress analysis and brazing test for design of the frontend pulse-by-pulse SR beam monitor.

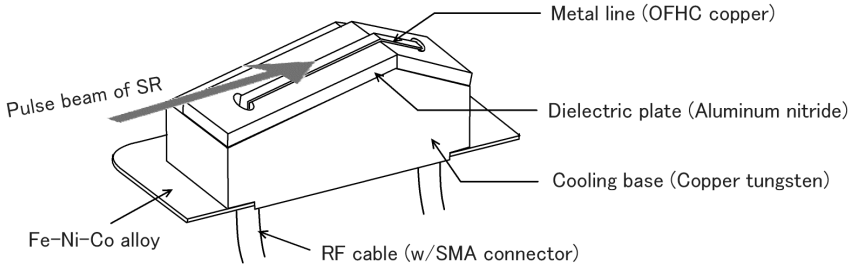


Figure1. Schematic view of the detector head of the frontend pulse-by-pulse SR beam monitor. The OFHC copper line has the width of 1.5 mm and the length of about 60mm. The AlN plates have the thickness of 1.65mm. This monitor was manufactured by KYOCERA Corporation.