Reconsideration of design criteria for high-heat-load components

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At SPring-8, we have been proceeding with a reconsideration of design criteria for high-heat-load front ends components (HHLC) to deal with an intensive heat load emitted from insertion devices, still increasing more and more. So far, generally speaking, the usage of HHLC was restricted within the range of elastic deformation. However, this restriction should be too conservative, because the thermal stress is the secondary one and a local yielding phenomenon will not lead an instant fracture. Therefore, our target is to present an actual and practical limitation including quantitative thermal fatigue life for each HHLC.

In the previous MEDSI (2004), we have carried out an elastic and plastic analysis successfully on a beryllium window, and established a method to predict life using the analysis solutions from the viewpoint of both fatigue and ratcheting effect [1]. Following this method, we turned our eyes to the practical limitation for HHLC made of GlidCop. This task consists of an investigation into actual material properties (the same heat treatment as the practical brazing was conducted), thermal fatigue test with an electron-beam gun system, and an evaluation by elastic and plastic analysis based on the beryllium window's case.

We will present the detail in the conference.

[1] S. Takahashi, T. Mochizuki, and H. Kitamura: MEDSI2004 Proceedings 04-16 (2005).