ESRF Thermal Absorbers: Temperature, Stress and Material Criteria

L. Zhang, J.C. Biasci, B. Plan

European Synchrotron Radiation Facility, 6 rue Jules Horowitz, BP220, 38043 Grenoble Cedex, France
Phone: +33 4 7688 2149; Fax: +33 4 7688 25859
E-mail: zhang@esrf.fr

Abstract

A great amount of thermal absorbers have been used to protect the ESRF storage ring vacuum vessels. These copper made thermal absorbers are cooled by water and have to remove very high power density heat load. For instance, a crotch absorber removes up to 8.16 kW of power at 200 mA current, with a peak linear power density of 72 W/mm or 177 W/mm^2 on the absorber. These thermal absorbers should be designed to withstand the temperature and thermal stress induced by the high heat load. The criterion of the thermal stress in the thermal absorber smaller than elastic limit of the material was mostly used in the design. Various experiences at the ESRF and tests made on the thermal absorbers show that this criterion is too conservative for the synchrotron radiation thermal absorber. This paper presents the design of some of the thermal absorbers made either of Glidcop or OFHC copper, the temperature and stress of the absorbers from finite element analysis, test results and operation experience with absorbers made of Glidcop or OFHC copper. Some points concerning the criteria to be considered in the absorber design will be discussed.

Keywords: storage ring, absorber, heat load, stress, criteria

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