Deformation Under Bake of Extruded Aluminum Narrow-Gap Vacuum Chambers at the ESRF

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Abstract

The ESRF uses NEG-coated vacuum chambers made of extruded aluminum in six of its 32 straight sections. These chambers are internally coated with a so-called NEG (Non-Evaporable Getter) film to support the pumping of the chamber and reduce photon-stimulated desorption. The chambers have an inner elliptical cross-section, 74 mm wide, with a vertical aperture of 11 mm, and 2-mm minimum wall thickness. In order to activate the coating, a bakeout of the chamber up to at least 180 degrees Celsius is required. Recently a new 5-m-long aluminum vacuum chamber has been produced with elliptical cross-section, 57-mm horizontal aperture, only 8-mm internal vertical opening, and 1-mm minimum wall thickness. Finite-element simulations show that during the activation bake the elastic limit of the chamber under vacuum is approached. This report describes deformation measurements on baking and venting cycles performed in our laboratory prior to installation in the ring. A contactless setup of laser distance sensors based on the triangulation principle has been used to compare the real deflection of the chamber to the prediction of the finite element analysis.

Keywords: insertion device, vacuum chamber, aluminum, deformation, NEG coating

Presentation: Poster