Several Technical Measures to Improve Ultra-High and Extreme-High Vacuum*

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UHV and XHV pressures are generally achieved by reducing the outgassing rate (hydrogen) of the stainless steel (ss) chamber walls and by providing large pumping speeds. Titanium nitride coatings were applied to ss walls to reduce the permeation rate of hydrogen but are not cost effective and so cannot be widely used. Copper and aluminum thin film coatings have been tried but the coating process itself introduces severe outgassing problem even though it has the potential of reducing the hydrogen permeation from the ss walls. Aluminum and Copper alloy (particularly beryllium copper, which is toxic) chambers have also been built since they have the lowest outgassing rate but have several disadvantages including the cost.

In this work, we investigated the use of inexpensive coatings of silica and titanium oxide on UHV/XHV chambers/components to reduce the adsorption/diffusion of water (which cracks into oxygen and hydrogen in the material and acts as the internal source of hydrogen) through the chamber walls thereby minimizing hydrogen outgassing. Further, we have also implemented backing of the turbo pump with an ion pump for reducing the vacuum chamber pumpdown times into UHV/XHV pressure range. The results of these investigations will be presented in this paper.

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