Submitting to International Workshop on Hydrogen in Materials & Vacuum Systems

The Outgassing Properties of SNS Ring Vacuum Chambers Coated with Titanium Nitride*

P. He[#], H.C. Hseuh and R. Todd

Collider-Accelerator Department Brookhaven National Laboratory Upton, New York, 11973

The stainless steel vacuum chambers of the 248m accumulator ring of Spallation Neutron Source (SNS) are coated with ~ 100 nm of titanium nitride (TiN) to reduce the secondary electron yield. The coating is produced by DC magnetron sputtering using a long cathode imbedded with permanent magnets. Reports in literature suggest that the potential benefit of a TiN coating as a hydrogen permeation barrier that reduces the ultimate outgassing rate. The room temperature (RT) outgassing rate, with and without 250EC *in-situ* bake, of TiN coatings deposited at various sputtering pressures, was measured and compared to uncoated chambers. It was found that the surface roughness of the film depends on the deposition pressure and glow discharge treatment (GDT) as measured by scanning electron microscope (SEM) and atomic force microscope (AFM); and the RT outgassing rate varies as a function of the density, or surface roughness, of the TiN layer. A 6-fold reduction in RT outgassing was measured in coatings produced at low pressure and with GDT. This coating also reduced the *in-situ* baked outgassing rate, showing evidence of a permeation barrier to H₂ diffusion.

*Work performed under the auspicious of US Department of Energy [#]Email: <u>phe@bnl.gov</u>