



Contribution ID: 218

Type: **Contributed**

Development and optimization of small diameter copper electroformed getter coated vacuum chambers

Tuesday 19 June 2018 11:30 (20 minutes)

The trend in electron accelerators design consists in approaching the poles of the steering magnets close to the electron beam. This implies reducing the bore hosting the vacuum chamber and using very small diameter vacuum pipes [1]. The application of functional thin films as getters by physical vapor deposition in such small diameter chambers becomes then very difficult. The aim of this project is to develop a novel procedure of coating/assembly, using a sacrificial mandrel as substrate of the thin film together with the creation of a surrounding copper chamber by electroforming [2]. The electroforming process should integrate the stainless steel vacuum flanges to the copper tube. This technology could enable to produce chambers of small diameter or complex shape, which fulfil the necessary criteria of vacuum tightness and low outgassing rate while keeping the best getter performance for the application in ultra-high vacuum systems of particle accelerators. As low as 3 mm diameter coated vacuum chambers were successfully produced using this method. After process optimization, TiZrV getter coating showed a good H₂ pumping performance with slightly delayed activation temperature compared to reference NEG coating values.

[1] C. Steier, A. Anders, D. Arbelaez, J.M. Byrd, K. Chow, S. De Santis, R.M. Duarte, J.-Y. Jung, T.H. Luo, A. Madur, H. Nishimura, J.R. Osborn, G.C. Pappas, L.R. Reginato, D. Robin, F. Sannibale, D. Schlueter, C. Sun, C.A. Swenson, W.L. Waldron, E.J. Wallen and W. Wan, Proceedings of IPAC, Richmond, USA (2015), p. 1840.

[2] L. Lain Amador, P. Chiggiato, L. M.A Ferreira, V. Nistor, A. T. Perez Fontenla, M. Taborelli, W. Vollenberg, M-L Doche, J-Y Hihn. Journal of Vacuum Science and Technology A, accepted.

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Session Classification: Vacuum Science & Technology

Track Classification: Vacuum Science & Technology