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Thermal Sprayed Phosphor Flags for Beamline Visualization in UHV Beamlines

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Beamline(s): X1B, X1A

Introduction: Beamline alignment and monitoring is greatly facilitated by phosphor flags that can be viewed through viewports in UHV beamlines. Preparing these phosphor flags from the powder is generally done by mixing the powder with some binding agent such as water glass, and sedimenting onto a solid support. Stronger adhesives are generally not UHV compatible. A major drawback of this conventional preparation is that in response to beam-induced charging the phosphor grains leave the surface, contaminate optical surfaces and entire experimental chambers, where a source of visible light often interferes with the signal to be measured.

Methods and Materials: We developed and tested an alternative form of UHV-compatible preparation. Plasma spray is a continuous directed melt-spray process, in which particles (e.g., 1-50 micrometers in diameter) of virtually any material are melted and accelerated to high velocities, through a DC non-transferred thermal plasma arc. The droplets impinge on a substrate and rapidly solidify to form a thin "splat". The deposit is built-up by successive impingement and inter-bonding among the splats, which accumulate into a well-bonded deposit, generally >5 micrometers thick. Plasma spray is widely used for the deposition of functional and protective coatings. The technology has emerged as an innovative and unique means for processing and synthesizing of high performance materials. The main advantages of the process are: (1) versatility with respect to feed materials (metals, ceramics and polymers in the form of wire, rod or powder); (2) capacity to form barrier and functional coatings on a wide range of substrates; (3) ability to create free-standing structures for net-shape manufacturing of high performance ceramics, composites and functionally-graded materials; and (4) rapid solidification synthesis of specialized materials. The technology is gaining acceptance for forming advanced functional surfaces, such as *electrical conductors, magnetic components, insulated metal substrates, bio-active materials*, and *solid-oxide fuel-cells.* [1]

Results: We used plasma spraying at the Stony Brook *Center for Thermal Spray Research* to coat stainless steel substrates with P31 phosphor. A 20mm thick coating provides a remarkably uniform coverage. It can be cleaned using the usual cleaning procedures, and baked as required. Light output from the coating is comparable to that obtained from samples prepared by sedimentation.

Conclusions: Two such flags are currently in use on the X1B beamline. We have found no evidence for beam-induced spreading of the phosphor grains from these coatings.

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References: [1] MRS Bulletin, Guest Editors: S. Sampath & R. McCune, No.7, **25**, 2000, pp. 12-53.

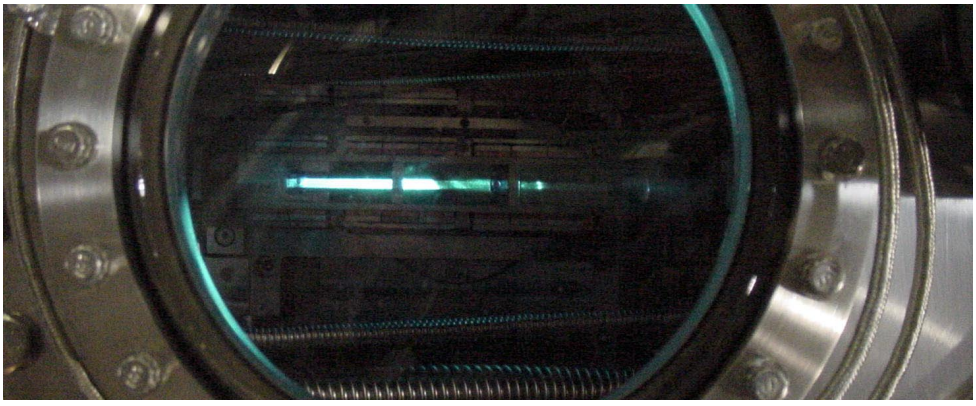

Figure 1. Phosphor flag on dummy blank in the X1B monochromator chamber.