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Creation of economical and robust large area MCPs by ALD method for photodetectors (12' + 3')

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We report a cost-effective and production doable path to fabricate robust large-area microchannel plates (MCPs), which offers the new prospective in larger area MCP-based detector technologies. We used atomic Layer Deposition (ALD) a thin film nanostructures growth technique, to independently adjust the desired electrical resistance and secondary electron emission (SEE) properties of low cost borosilicate glass capillary arrays (MCAs). These capabilities allow a separation of the substrate material properties from the amplification properties. This methodology offers the functionalization of microporous, insulating MCA substrates to produce sturdy large format MCPs with unique properties such as high gain (>1E7/MCP pair), low background noise, 10x ps time resolution, 100x micron spatial resolution and stabilization with short (2-3days) scrubbing time.

The ALD self-limiting growth mechanism allows atomic level control over the thickness and composition of resistive and secondary electron emission (SEE) layers that can be deposited conformally on high aspect ratio (<100) capillary glass arrays. We have developed several robust and consistent ALD processes for the resistive coatings and SEE layers to give us precise control MCPs parameters. Further, the adjustment of MCPs resistance by tailoring the ALD material composition permits the use of these MCPs at high or low temperature detector applications. Here we discuss ALD method for MCPs functionalization and variety of MCPs testing results.

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