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Elimination of Crazing Defects in Large Area Sputter Coating of Glass

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In large area coating of architectural glass, one cause for yield loss is the so-called crazing. This refers to the formation of dendritic traces on the glass surface due to electric break-down within the coated layer stack during sputter deposition. The occurrence of these defects is, like their appearance of erratic nature and hence the root cause analysis and mitigation pose a significant challenge.
Recently, methods to minimize or avoid crazing has increasingly moved into the focus of glass manufacturers, due to two reasons: the increased density of sputter magnetrons in coaters and the increasing use of Bipolar power supplies. The underlying mechanism leading to crazing is related to the difference between plasma potential and the ground potential. For MF or sine wave power supplies, one way to minimize crazing is to use rather low output frequencies of about 20 kHz. The Bipolar power supplies allow appropriate selection of not only the output frequency but also of the operation mode and thus, the output signal shape.
In this contribution, we first investigate the electrical signals used in dual magnetron sputtering. We compare their nature and characteristics when a sine wave (MF) and a modified square wave (Bipolar) is used and make an assessment of their influence on the crazing likelihood. Finally, the configurability of Bipolar operation mode and frequency combined with proper means to evaluate the plasma potential with respect to ground and the application of a self-learning algorithm for fine-tuning of plasma discharge parameters will be demonstrated as an effective method to eliminate crazing defects.

Keywords
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Surface defects
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Dual magnetron sputtering
Large Area Coating