Characterization of Anti-Soiling Coatings for PV Glass: Understanding Functionality and Degradation Pathways

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When dust and other particulates accumulate on the surface of solar cells the efficiency of producing electricity with these soiled cells is significantly reduced. Soiling is especially problematic in regions with little rain, where water resources for cleaning cells are scarce. To combat this issue, multifunctional coatings, on the top-surface of solar cells, combining antireflection and anti-soiling, are beginning to enter the market. However, limited understanding of anti-soiling mechanisms and uncertainty in the durability of anti-soiling coatings (ASCs), has limited the deployment of ASCs. In this work, we use several oxides films as a starting point for exploring the role of surface energy and surface chemistry in anti-soiling. Water contact angle and X-ray photoelectron spectroscopy are used to measure surface energy and surface chemistry, respectively. Anti-soiling capabilities are determined through UV-Vis spectroscopy performed before and after soiling. This baseline characterization will provide a springboard for understanding the role of surface chemistry in anti-soiling. Furthermore, this work will serve as a reference point for planned future studies examining how soiling changes and possibly degrades the surface chemistry of coatings. This work is a part of the Durable Materials Network (DuraMAT) which is a collaboration between industrial partners and US national labs aimed at building an understanding of the source and level of durability in ASCs. Ultimately, this study will result in a better understanding of ASCs and provide guidance for improved performance and durability of multifunctional coatings for photovoltaics.