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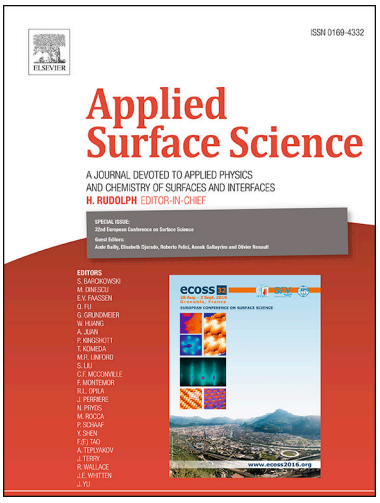

Full Length Article

Low Energy Ion Scattering (LEIS) of As-Formed and Chemically Modified Display Glass and peak-fitting of the Al/Si LEIS peak envelope

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Low Energy Ion Scattering (LEIS) of As-Formed and Chemically Modified Display Glass and peak-fitting of the Al/Si LEIS peak envelope

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Abstract

Flat panels displays (FPDs) are commonly manufactured on highly-engineered glass substrates known as display glasses. As FPD pixel sizes decrease and pixel densities increase, the surface composition and surface properties of these glasses have an increasingly important impact on device yield, influencing static electricity buildup and discharge, particulate adhesion, rate of contamination, and device lifetime. Here, we apply low energy ion scattering (LEIS) to the analysis of Eagle XG®, a widely used display glass. Surfaces were treated with production-line relevant chemistries including acids, bases, etchants, industrial detergents, and plasmas. The resulting surfaces were compared to as-formed melt surfaces, fracture surfaces, and fibers formed from remelted Eagle XG®. LEIS revealed the elemental composition of the outermost atomic layer of these materials, detecting all major Eagle XG® constituents except boron. The surface composition of the glass differed as a function of forming process used to fabricate it as well as surface treatment. The surface concentration of aluminum on the as-formed melt surface differs significantly from the bulk composition. HCl treatment depleted the surface of all species except silica. HF treatment depleted modifier species from the glass surface to a lesser extent. An alkaline industrial detergent produced an increase in alumina relative to the as-formed glass surface. Treatment with an atmospheric-pressure plasma had no detectable impact on the elemental surface composition of the glass. Aluminum and silicon generally give overlapping signals in LEIS, and these signals could only be resolved here through a combination of optimized experimental conditions and data fitting. Various approaches to this data analysis were explored, including a guided least-squares approach herein referred to as informed sample model approach (ISMA), wherein the pure spectral components required for the fit were mathematically derived from the sample spectra. Most commercial display glasses contain both Al and Si, but there is little discussion of the deconvolution of these LEIS signals in the technical literature.