

Application of Synchrotron EDXRD Strain Profiling in Shot Peened Materials

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We have implemented an energy dispersive x-ray diffraction (EDXRD) method to profile the detailed depth variation of the strain, over several mm of steel, on X17B1 at the Brookhaven National Synchrotron Light Source. One of the most important near surface strain problems is the failure of engineering components due to cracking. The creation of near surface compression, by shot peening, is a classic industrial technique for surface toughening to extend the loading limits and fatigue life of materials against crack failure. Using our EDXPD method we have measured the detailed depth variation of the strain in high carbon spring steel plackets treated under varying peening parameter conditions. Our results directly elucidate a number of important issues: the degree and depth of the near surface compression; anisotropies in the strain field distribution; the systematic coupling of the peening-compression to the underlying plackets elastic strain; and the correlation of the strain profile with the plackets radius (R) of curvature, typically used to empirically quantify the peening effect. In some cases, simple elastic/plastic modeling is used to quantitatively understand the experimental results.

1. The above abstract can be posted on the DXC web site and affiliated web sites.
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3. Oral presentation is preferred in “Industrial Applications of XRD” session.
4. We intend to publish the paper in Advances in X-ray Analysis, Volume 46.