

Aviation and Aerospace



Developing Better Turbine Blades

Titanium aluminum nitride coatings are known for their durability and ability to resist particle erosion, and are therefore used on integral components such as turbine blades in the aerospace industry. The coating on blades was examined using non-destructive methods to determine its behaviour once it was applied. The property of the coating was dictated by how it crystallizes, which depended on the amount of aluminum present in the mixture. The structural information determined by the CLS helped the manufacturer understand differences in the performance of the coating when in service. ✨



Tougher Planes, Bicycles and Hockey Sticks

Composites are materials made of two compounds blended together. Carbon fibers, amongst the strongest materials in the world, are bonded to other materials by an epoxy (a polymer resin), and the interaction between the fibers and the epoxy is of key interest to researchers. Using Scanning Transmission X-ray Microscopy (STXM), researchers at CLS have discovered that the epoxy bonds to the carbon fiber, not just by contact, but also by electrostatic interaction. If the two bond properly and in the correct proportions, the resulting composite can have incredible strength and be used in a wide range of materials, from airplanes and satellites, to hockey sticks, boats and bicycles. ✨



Better Coatings for Boats, Aircraft, and Satellites

Paints and coatings are important for many structural materials, and are used for protection as well as cosmetic purposes. Materials may also be coated in order to change or reinforce a material's property; for example, some coatings may provide a material with more strength, while others may be added for lubrication purposes. Using the CLS's X-ray Absorption Spectroscopy (XAS) capabilities, scientists are developing a better understanding of these properties and how they affect the final product. This research will result in the development of stronger, more corrosion-resistant coatings for boats, aircraft, and satellites. ✨



Building Stronger, Lighter Satellites

Metallic glasses are amorphous mixtures of metals with no crystalline structure that can show up to a 300% increase in strength over more conventionally constructed counterparts, as well as being significantly lighter. Satellites made of metallic glasses could save up to \$6 million per rocket launch, due to their strength and reduced weight. To better understand this material, CLS and collaborators from the University of Virginia are investigating its fundamental properties to understand and predict which mixture of materials will give the optimal qualities in the areas of strength, weight, corrosion resistance and malleability. ✨