UV Degradation Prevention on Fiber-Reinforced Composite Blades

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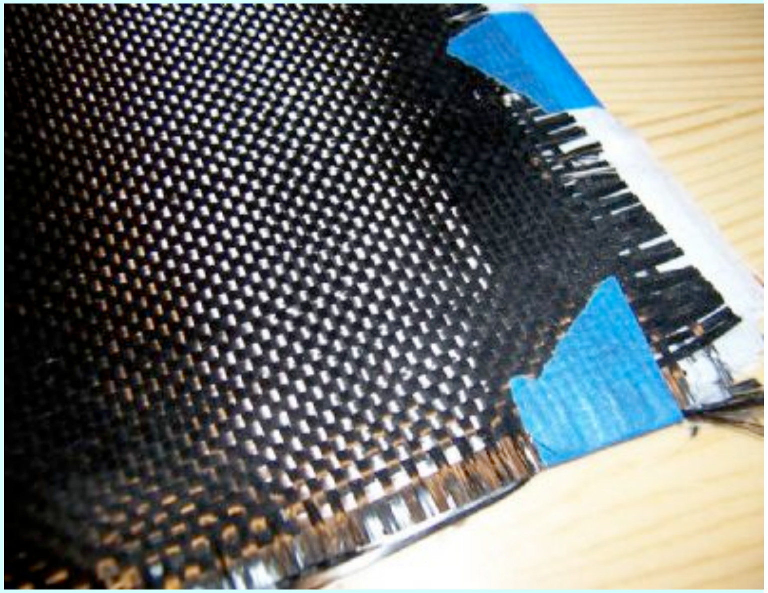
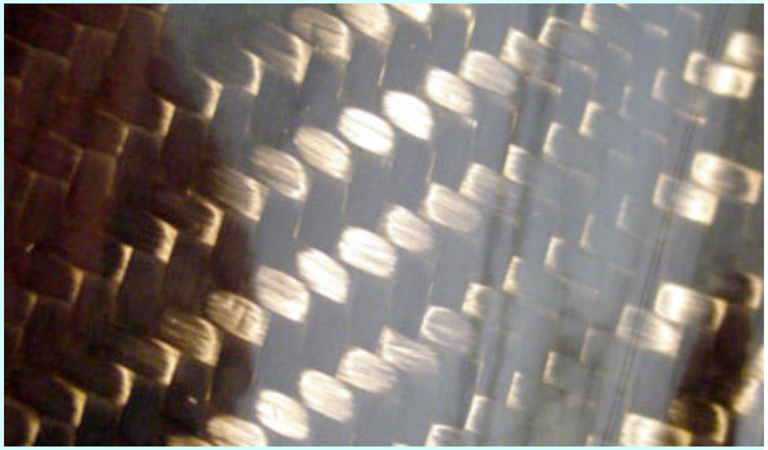
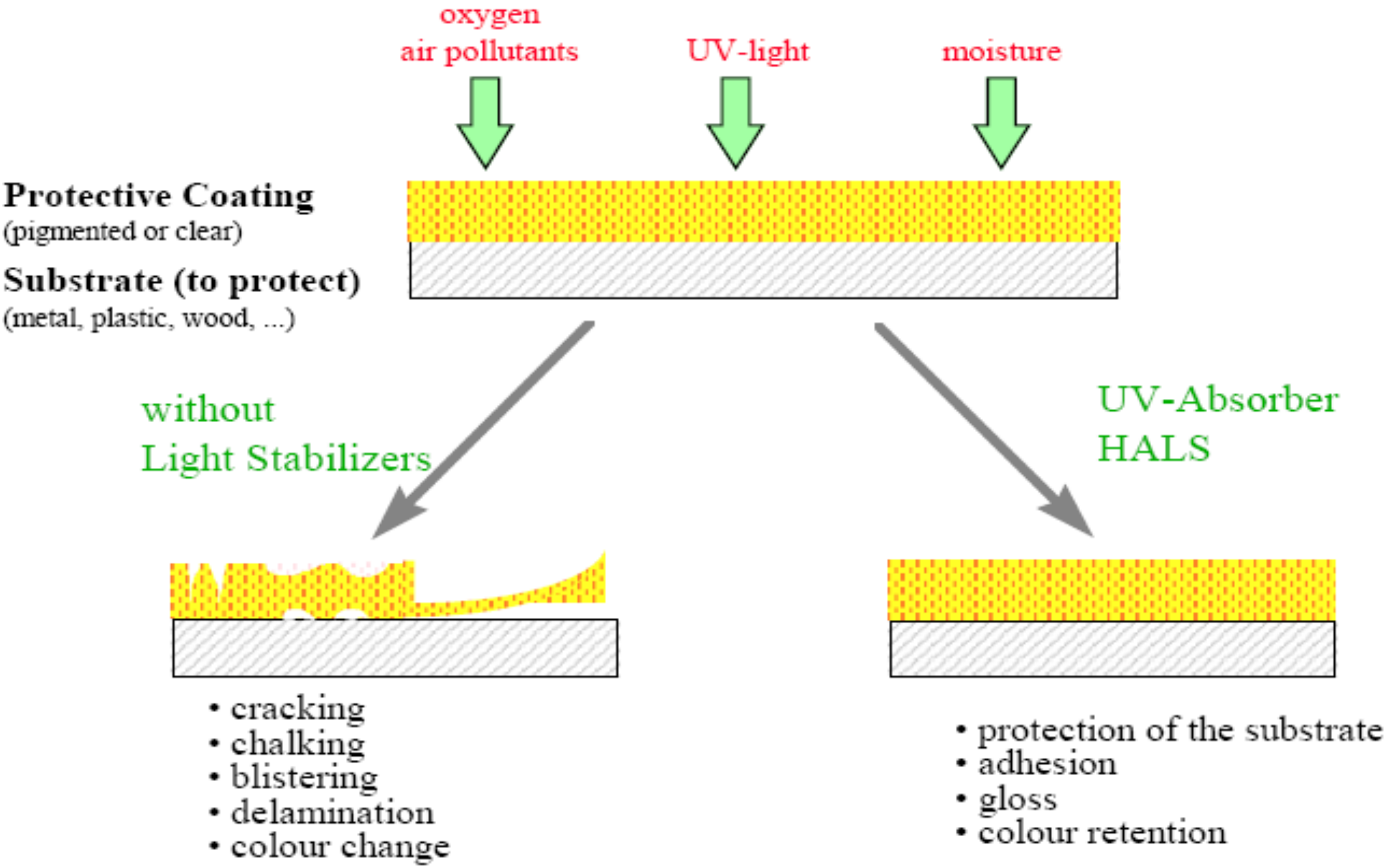
Composite Wind Turbines





Carbon fiber reinforced composites are usually preferred for wind turbine blade manufacturing.

Environmental Effects on Coatings



Atmospheric influences of organic coatings and their degradations

Atmospheric Influences

Atmospheric influences coming from UV light, sea water, acid rain, emissions, pollutants, chemical products and/or industrial wastes entirely degrade the organic coating and its degradation.

UV light radicalizes the polymer chains and increase crosslinking reactions.

Surface hydrophobicity reduces from 80 to 10º, where water can be absorbed more into coatings.

Technical Approach

The **objective** of the present project is to develop a nanocomposite coating for the protection of fiber reinforced composite wind turbine blades against the UV degradation and corrosion.

The nanocomposite coatings are prepared by individually combining inorganic nanoparticulates into polymeric matrices, such as a variety of epoxies and hardeners, polyethylene, polyurethane, fluorinated polyurethane, polypyrrole, polyamide, polyester, organosilanes, etc. These polymers are favorable coating materials with a wide variety of osmotic barrier, and chemical, thermal, hydrolitic, and oxidative stability properties.

Inorganic nanowhiskers, nanotubes, nanoparticles and nanowires including CNTs, ZnO, CdSe, TiO2, ZrO2, CdTe, and Al2O3 are utilized to improve the mechanical strength, and UV and corrosion resistance of the coatings.

Advantages of the Project

- Mechanisms of nanocomposite coatings can be determined for UV degradation and corrosion protection,

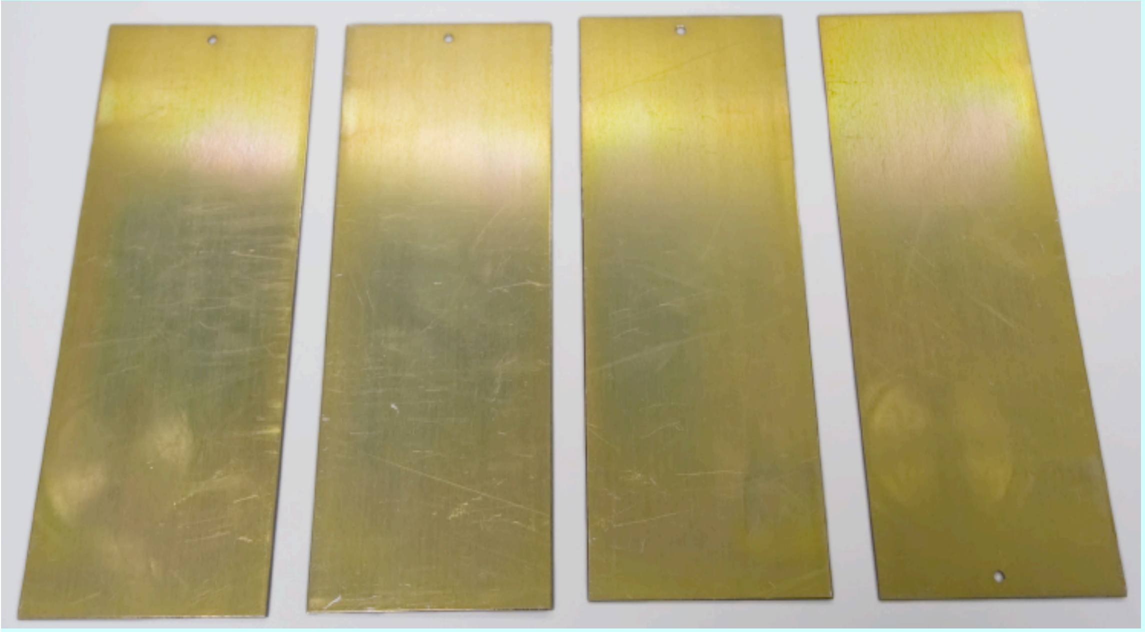
- Mechanically strengthened coating materials can be produced for long term use,

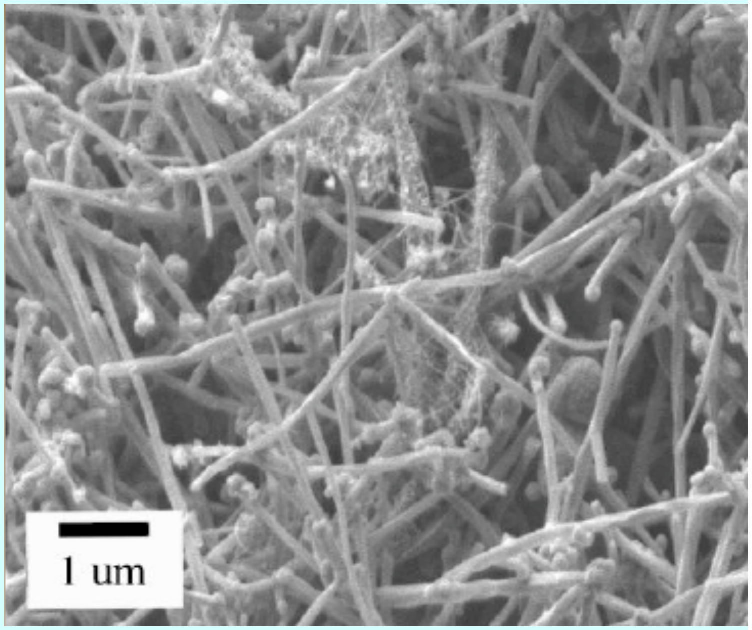
- Oxidation and degradation level of the nanocomposites, which are caused by environmental influences (e.g., UV light, humidity, temperature, and wind) can be lowered,

- Lightning strikes that cause serious problems on the blades can be prevented when conductive inclusions are chosen for the coating, and

- Inspection of the nanocomposites could be faster.

Samples

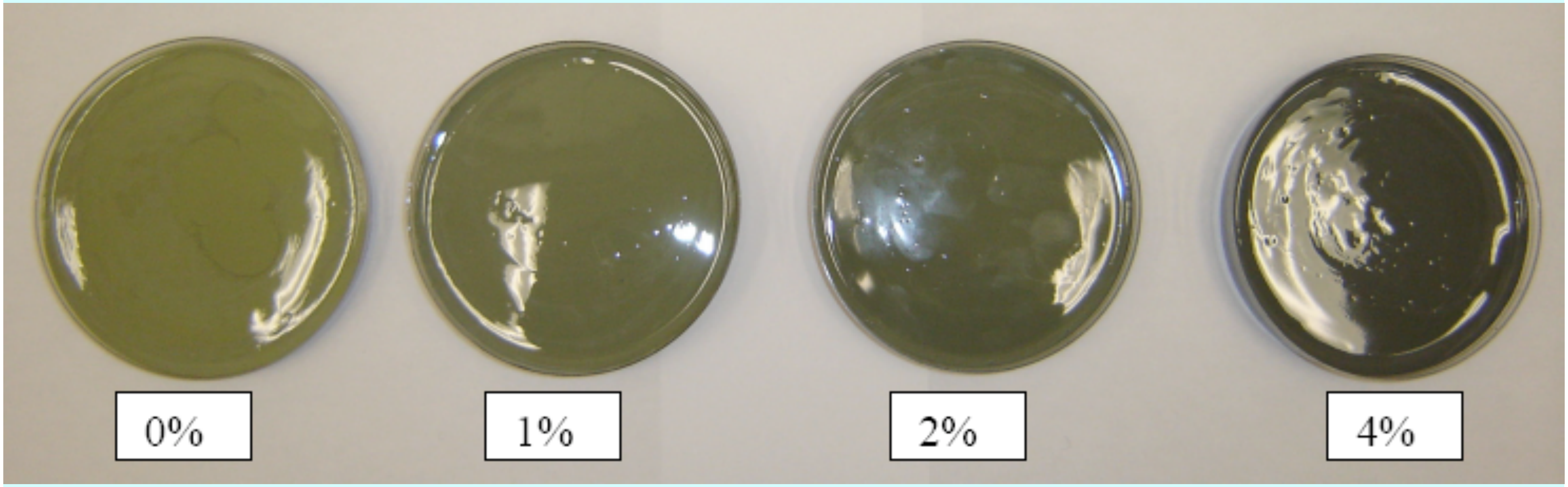




Unclad 2024-T3 aluminum panels with chromate conversion coating used as a model surface.

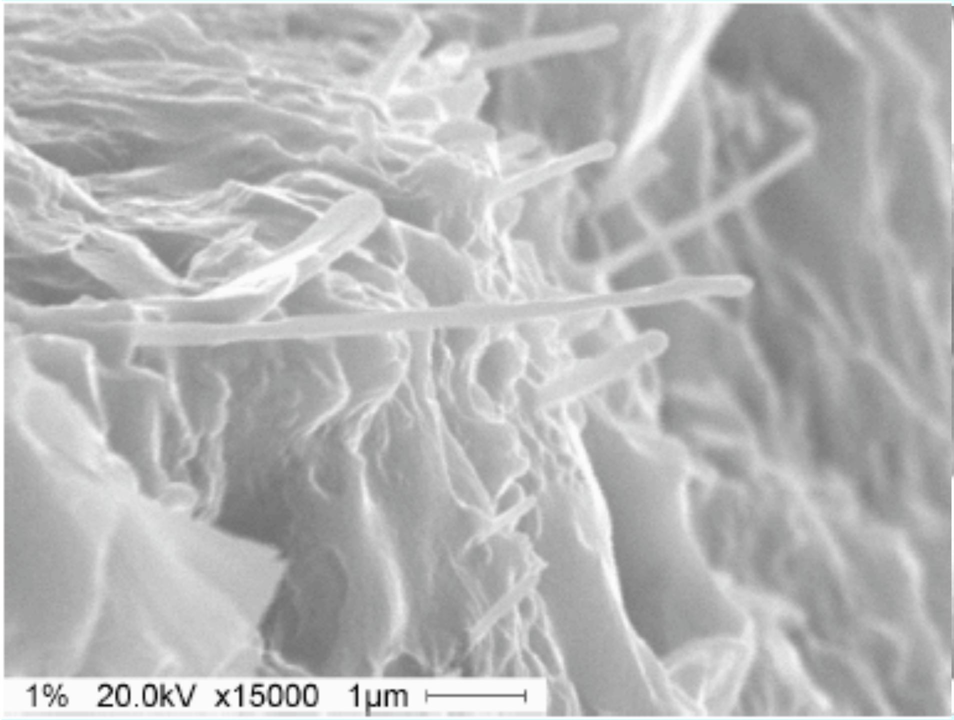
MWCNTs were characterized as 140 nm in diameter and 7 microns in length with a purity of ninety percent.

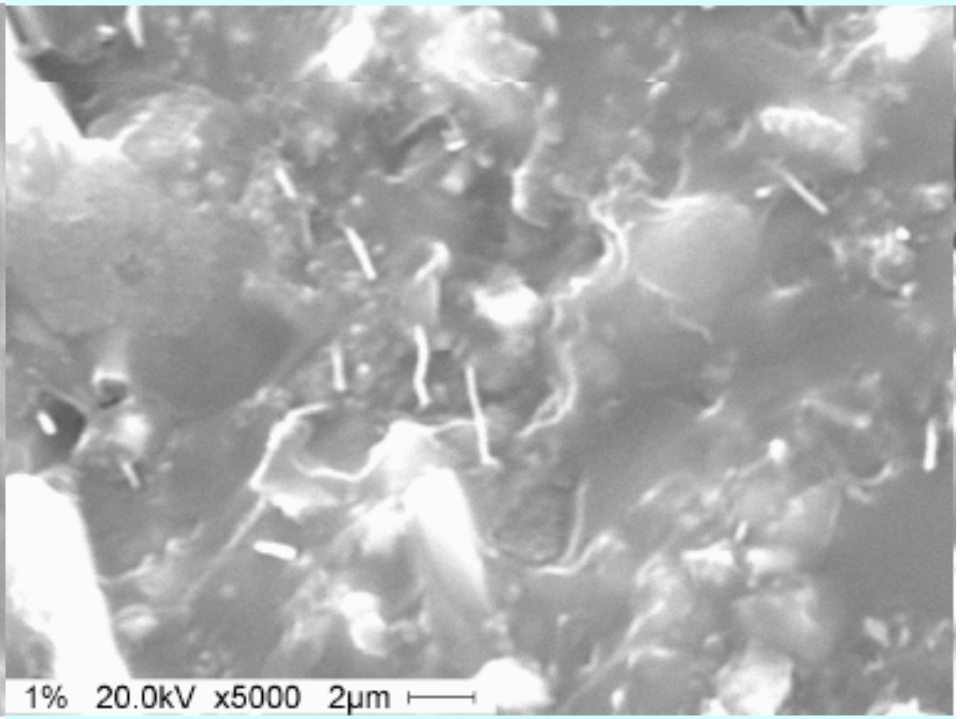
Experimental



Different weight percents of CNTs nanocomposite coatings in the Petri dishes.

Dispersion of CNTs

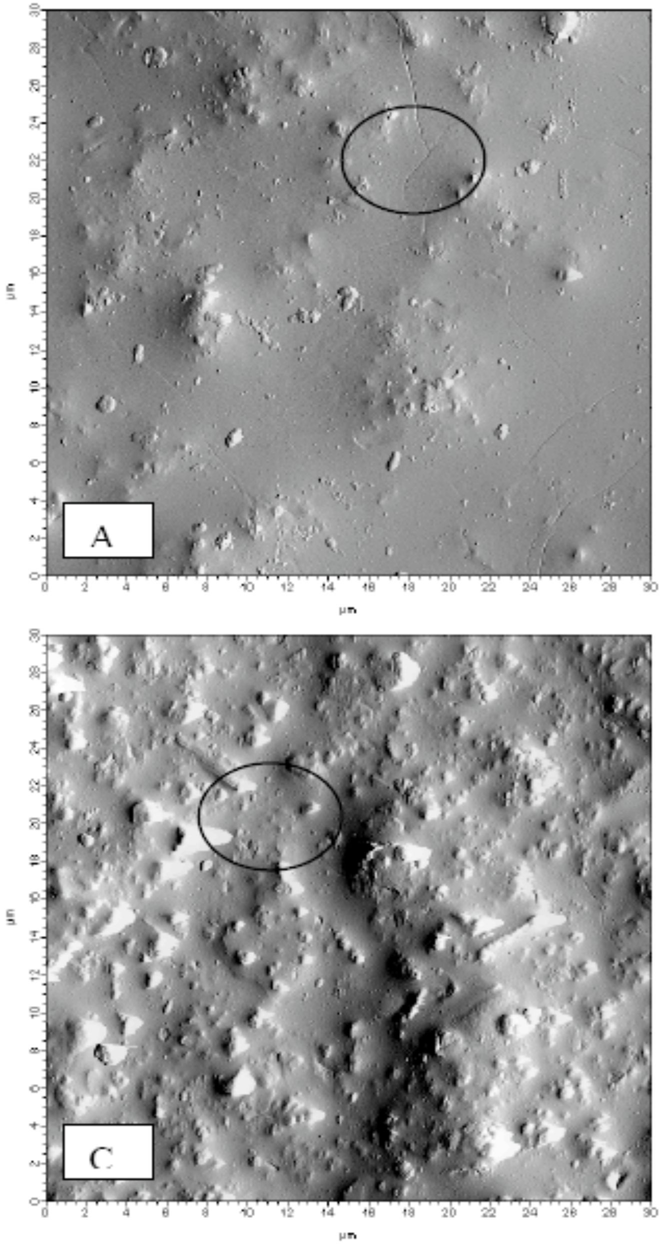




SEM images showing the 1% CNTs distribution into the nanocomposite coatings. All samples were sputter coated prior to the SEM analysis.

Next study includes UV degradation and corrosion studies.

Corrosion Studies



AFM images showing the crack formations on the coatings at 0.5% (above), while no crack formation at 2% CNTs coatings after 40 days of salt solution exposure.

This will likely increase the lifetime of the blades.

Thank You

Questions
And
Comments