

4.3.1. CHEMICALLY ACTIVATED NANODIAMONDS AS NANO-AGENTS FOR SHM-APPLICATION: PROTECTIVE AND SMART COATING FOR ALUMINUM ALLOYS

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The present study shows a novel way of using chemically activated nanodiamonds as nanoagents for structural health monitoring. A corrosion protective coating for aluminum alloys will be presented; it also enables the implementation of a corrosion monitoring system. In combination with non-toxic anodizing methods, an improvement of the electrochemical properties has been observed. The nanodiamonds are deposited onto AA2024 sheets from aqueous dispersions. The preparation of the nanodiamond dispersions is a critical factor determining the quality of the coating. The fluorescence properties of the nanodiamonds were investigated in order to evaluate the possibility of corrosion monitoring.

Light alloys, especially aluminum alloys, are widely used in aircraft as well as automotive industries with the aim of weight reduction in order to be both energy- and cost-efficient.

While aluminum and aluminum alloys are generally well protected from corrosion by their native oxide layer, the protection may fail under operation conditions. Mechanical strain as well as photochemical interaction with degradation products from the lacquer coating under the influence of UV-light may cause damage in rivet connections and weld seams. Therefore, a hard-wearing, ideally self-healing, protective coating is needed and is presently achieved by chromium conversion coatings. However, the aircraft and automotive industries are facing the problem of eliminating Chromium (VI) compounds from production, as these are both carcinogenic and harmful to the environment [1]. A number of different organic and inorganic anodizing electrolytes have been discussed as substitutes. However, up to date there is non known to the authors that achieves the high quality standards of chromium conversion coatings with respect to corrosion protection and lacquer as well as structural element adhesion. The coating discussed in this study is based on chemically activated nanodiamond particles in combination with non-toxic anodizing.

References:

1. **Guidelines** 2000/53/EC of the European parliament, published 18.09.2000.