

## **DMPO Spin Trapping Studies of Hydroxyl Radical Generation by Pigments Employed in Surface Coatings for Steel**

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DMPO spin trapping is applied to study photocatalytic activity of inorganic pigments commonly used in industrial paints and surface coatings, particularly those employed in exterior applications of pre-painted steel. Aqueous pigment slurries are irradiated in bulk with high intensity UV light in the presence of DMPO. Hydroxyl radicals formed by photocatalysis are trapped. The increase in concentration of DMPO-OH spin-adduct is monitored with time and several interesting observations are described. Discrimination between pigment (rutile) grades of TiO<sub>2</sub> with different levels of silica surface modification (and therefore of differing exterior durability) can be made. Pigment grades with zirconia surface modification are clearly distinguished by these experiments - the results indicate a different mechanism for electron/hole pair deactivation to the silica modified grades. Modification of experimental conditions allows photocatalytic (anatase) grades of TiO<sub>2</sub> to be studied and assists in differentiation of oxidation pathways. In terms of TiO<sub>2</sub> photocatalytic activity, we estimate over eight orders of magnitude in hydroxyl radical generation rate are accessible by DMPO spin trapping.

The technique is also applied to both regular and nano-sized metal oxide pigments of relevance to UV protection of surface coatings, and could be particularly useful in production of the doped rutile mixed metal oxide class of premium durability pigment. Other application areas include optimization of photocatalyst activity in green technologies for water clean-up, and sunscreen development.