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# Crystal structure control in pulsed-pressure MOCVD

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$TiO_2$ solid coatings on complex shaped metal or glass objects could find a wide range of applications that utilize the photocatalytic and optical properties. [1] The thickness, structure and crystal orientation can have a significant effect on the photocatalytic activity of a $TiO_2$ thin film. [2] A range of processes have been explored for producing solid $TiO_2$ coatings on metal [3], but controlling the structure remains a challenge. [4] We have significant experience with deposition of $TiO_2$ by pulsed-pressure MOCVD from TTIP. [5] This work investigates the control of the crystal structure and orientation of $TiO_2$ on stainless steel and glass by control of the substrate temperature alone. The photocatalytic activity as a function of light wavelength, reflectance, color, wear, adhesion and other important functional properties are related to the crystal structure and morphology. The stoichiometry, phase and orientation of crystals depend on the growth rate and temperature. The paper reviews the experiences with $TiO_2$ deposition over many years using the pulsed-pressure MOCVD process. Our current research objective is to develop the empirical models for the crystal growth process. The aim is to use the exact control of the deposition process afforded by pp-MOCVD to achieve desired properties and performance for commercial products.

The pp-MOCVD process uses direct liquid injection through an ultrasonic atomizer with no carrier gas, and represents a relatively simple and cost-effective way to manufacture a functional coating for practical applications. Figure 1 shows the effect of deposition temperature on the crystal structure of $TiO_2$ on glass. The substrates are heated by induction heating of a stainless steel susceptor. The coatings are 10 μm in thickness. The growth rate varies with temperature and with precursor solution concentration between 5-10 μm/hr. The coating is solid anatase, but the microstructure varies greatly with deposition temperature. Adhesion, absorption spectrum, color and photocatalytic activity are also shown to vary distinctly with the microstructure.

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