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SiOxNy AND SiOxCy COATINGS BY CHEMICAL VAPOR DEPOSITION (CVD) FOR APPLICATIONS AS AQUEOUS CORROSION BARRIERS

Revêtements SiOxNy et SiOxCy par CVD pour applications comme barrières de corrosion aqueuse

Chemically inert silicon oxide (SiO_2), oxynitride (SiOxNy) and oxycarbide (SiOxCy) thin films are studied, in order to utilize them as corrosion barrier films in industrial applications. The creation of such thin films is done through an innovative, thermally activated chemical vapor deposition (CVD) process. This process involves the introduction of an organosilicon precursor (tetraethyl orthosilicate, TEOS) in a heated reactor, while in the presence of ozone. Importance is placed on the generation of free radicals through ozone's decomposition, which significantly helps reduce the process temperature, compared to other processes (e.g. TEOS-O_2 CVD, or TEOS pyrolysis). This allows for the treatment of thermally sensitive substrates like those frequently used in the microelectronic and glass industries.

Based on tuned process conditions for SiO_2 deposition from the above gas mixture, the films' corrosion resistance will be improved through the addition of specifically selected N- and C-precursors. The aim is the partial replacement of O anions by highly coordinated N and C ones, a substitution which results in improved barrier and mechanical properties, therefore providing efficient protection against aqueous corrosion. Based on composition and structural information, which will be gathered from various characterization methods and corrosion tests, the efficiency of each thin film will be analysed.

The optimization of the deposition process is assisted by computational fluid dynamic (CFD) computations and kinetic models, developed from experimental and bibliographic data. The final aim is the direct transfer and industrial implementation of the produced materials, through customized tuning of the coating conditions.