Can Vanadates Replace Chromates?

What Can We Learn from Neutron Reflectivity

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Background

Chromate primer

- Cr(VI) → Toxic
- Non chromate anti-corrosion → In demand

Vanadate Conversion Coating System (VCC) → Promising Candidate

Research Objective

- Structure
- Species
- Stability

Top Coating

Metal + Oxide

VCC

Formulation of VCC

(R.G. Buchheit, OSU)

VCC (/100g solution)

NaVO_3 (0.61g)

K_3[Fe(CN)_6] (0.987g)

NaF (0.084g)

Substrate preparation by E-beam

 Silicon

A2024

Porous Oxide Layer

Technical and Strategy

Basic of Neutron Reflectivity (NR)

Interference

Reflectivity

Scattering Length Density (SLD): The scattering power

SLD is determined by atomic composition and density

Advantage of NR

Sufficient to Composition

Easy to See Changes in Buried Layers

Substrate

Epoxy

VCC precursor

A2024

Dissolution

Fast Precipitation

Retarded Growth

Condensation

Experimental

VCC Growth under Epoxy

H_2O Aging

Sample

VCC precursor

A2024

200 °C

Water

Swelling

Shrinkage

Film Structure

Growth Kinetics

Species

Degradation

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