

FABRICATION OF METAL MATRIX COMPOSITES BY CO-DEPOSITION

Co-deposition is a process, in which matrix metal is deposited together with the dispersed phase by one of the deposition techniques.

The following co-deposition methods are used for manufacturing Metal Matrix Composites:

- **Electrolytic co-deposition**
- **Spray co-deposition**
- **Vapor co-deposition**

Electrolytic co-deposition

This method (Electrolytic co-deposition) involves Electroplating technique, in which electrolyte solution of matrix metal ions contains suspended particles of dispersed phase. When the matrix metal is deposited on a substrate, the dispersed phase particles are entrapped by the coating, reinforcing the matrix material.

Examples of electrolytic co-deposition:

- Nickel matrix composite materials with various dispersed phases are fabricated by electrolytic co-deposition from Nickel Sulfamate and Watts electrolytes:
- Ni- Al_2O_3 - oxidation resistant nickel matrix composite;
- Ni-SiC – wear resistant nickel matrix composite;
- Ni-PTFE, Ni-C, Ni-MoS₂ – antifriction nickel matrix composites.
- Anti-friction coating of Engine bearings consisting of lead-tin-copper alloy and reinforced by alumina (Al_2O_3) is fabricated by electrolytic co-deposition from electrolyte solution of lead, tin and copper with alumina particles.
- Aluminum matrix material reinforced by silica (SiO_2) is prepared from AlCl_3 -dimethylsulfone electrolyte containing fine silica particles.

Spray co-deposition

This method implements Thermal spraying technique for atomizing molten matrix metal, droplets of which are delivered to a substrate in a high velocity gas stream together with dispersed phase particles supplied to the stream from a separate container.

The method allows fabrication of near-net-shape forming of Metal Matrix Composites.

Examples of spray co-deposition:

Aluminum matrix material reinforced by silicon carbide (SiC) is produced by spray co-deposition followed by Rolling.

High Velocity Oxyfuel Spraying (HVOS) method is used for fabrication tungsten carbide-cobalt (WC-Co) composite material, which is conventionally manufactured by more expensive technology of sintering fabrication of Metal Matrix Composites.

Vapor co-deposition

Vapor co-deposition is a group of various methods, utilizing materials in vapor state: Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD), Direct Vapor Deposition (DVD).

In these methods coating of solid material is formed as a result of vapor condensation or chemical reaction on a substrate surface.

Vapor co-deposition is used for coating fibers, creating multilayer depositions, fabricating nanostructure composite materials.

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