

Writeup on 'Polyurea-coating technology'

Elastomeric spray-on coatings are being advocated as excellent retrofit materials for strategic applications, particularly for blast mitigation and ballistic protection. The most important properties of polyurea include the ease of application, rapid cure time, adhesive properties and excellent mechanical properties. Polyurea undergo massive flexure, when subjected to blast and impact, thereby absorbing or dissipating the energy arising from dynamic loads.

Polyurea is a reaction product of isocyanate and amine, which are sold in the market as a two-component system, namely 'Side A (isocyanate)' and 'Side B (amine)': To achieve optimal mechanical properties, the formulation of amine resin (Side B) needs to be an optimal blend of 'long chain amine', 'cross-linker' and 'chain-extender'. The quantities of each component need to be optimized, which require extensive experimentations.

DRDO has developed a two-component system (isocyanate prepolymer and amine blend), which can be reacted to form a polyurea coating on any surface. The properties of the coating can be tuned by varying the individual components in the amine resin blend. Fire retardant properties have been introduced by including a phosphorus containing amine in the resin blend. An Indian patent in this regard is being filed. The proposed technology for transfer discloses the optimal amounts of the ingredients mentioned above.

Mechanical properties of polyurea*

- Tensile strength: 15.6 ± 0.5 MPa, ASTM 412C
- Elongation: 265 ± 9 % ASTM 412C
- Tear strength: 63 ± 3 N/mm, ASTM 624 C
- Tack free time: 15 s
- Shore Hardness: 96 (Shore A)

* Spraying conditions: Spray coating equipment (Graco E10HP) equipped with fusion air purge spray gun AW 2222. Operating pressure 2000 ± 100 psi, Temperature 75°C .

Visible reduction in damage was evident when the developed polyurea coating was applied onto the tension side of the concrete tile and subjected to blast loads. Concrete tiles underwent extensive fragmentation at ~ 50 psi peak pressure. Coated tiles (6 mm polyurea coating) could withstand ~ 90 psi peak pressures.