Thick coatings of polyolefins with flame retardant properties

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Goal

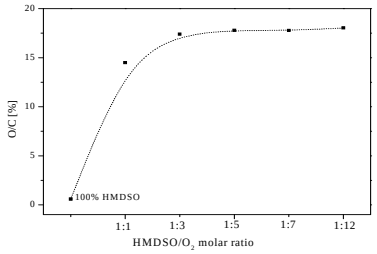
Polyolefin construction materials shall be enwrapped with thick inorganic or organic polymer coatings. These layer shall be well-adherend, may be covalently bonded, and should have flame-retardend properties.

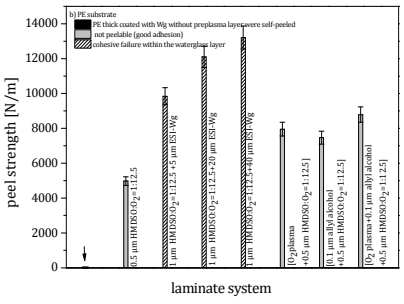
Line of action

Polyolefins were exposed to oxygen plasma for formation of OH, COOH and other groups. Then, hexamethylenedisiloxane (HMDSO/O2) for inorganic layers and allylamine or allyl alcohol for organic layers were plasma deposited as thin adhesion-promoting and thermal expansion compensating layers (100 nm). It is followed by dip-coating in waterglass or melamine prepolymer solution with and without curing, also polyphosphates were used. Thus, 50 µm flame-retardant layers were deposited with sufficient adhesion also in case of high thermal gradients at exposure to flame.

Siloxan coating

Structure:
PE (PS)//HMDSO plasma polymer//water glass (50 µm)

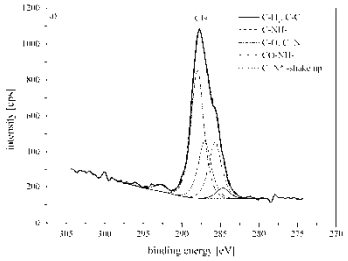


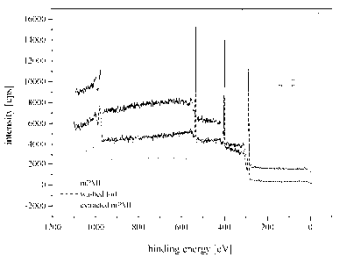


Results
Composites adheres very strongly, not peelable.
Fire retardancy was moderately improved.

Melamine coating

Structure:
PE (PS)//polyallylamine// melamine resin+hardener

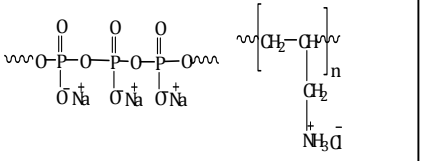




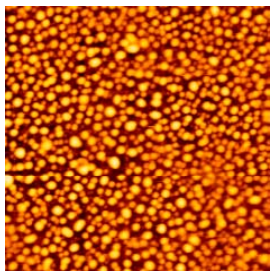
Results
Composites adheres very strongly, not peelable.
Fire retardancy was slightly improved.

Polyphosphate coating

Structure:
PE (PS)//polyallylamine// polyphosphate



Sodium polyphosphate (PSP) | Poly (allylamine hydrochloride) (PAH)



Results
Composites adheres very strongly, not peelable.
Fire retardancy was significantly improved.

Conclusions

Enwrapping of polyolefin material with well-adherent thick flame-retardand layers assisted by by plasma processing is successful and is an alternative to blending the polymer bulk with great amounts of flame-retarders despite of more complicated processing.