# Poly(Phenylene Methylene): A Photoluminescent, Corrosion-Protective Coating Material

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In this study poly(phenylene methylene) (PPM, Figure 1 a) is explored as protective coating for the high strength aluminum alloy AA2024, widely employed in aerospace applications.

PPM is a hydrocarbon polymer which consists of an alternating sequence of phenylene and methylene units. PPM unexpectedly exhibits photoluminescence, due to the rare phenomenon of homoconjugation which is a consequence of overlapping of π orbitals of adjacent electronically separated phenylene rings through space (Figure 1 b) [1]. In addition, PPM possesses high thermal stability [1] (onset of decomposition 450 °C – 470 °C) that overcomes the thermal stability of common organic materials, and shows hydrophobicity [2].

First the compatibility between the hydrophilic surface of the aluminum alloy and the hydrophobic PPM was improved by application of a layer of polybenzylsiloxanes (thickness 1μm). Subsequently the substrates were covered with a PPM film by hot pressing. Formation of bubbles and cracks was reduced by addition of polybenzylsiloxane and benzyl butyl phthalate to the PPM, resulting in very uniform, fluorescent films (Figure 1 c). The electrochemical results of measured current densities (anodic polarization potentiodynamic analyses) revealed a very favorable protective behavior to the corrosion of the metal, if compared to other organic coatings. Most remarkably the PPM coating exhibited a self-healing effect, i.e. corrosion processes were stopped in the initial phase [2].

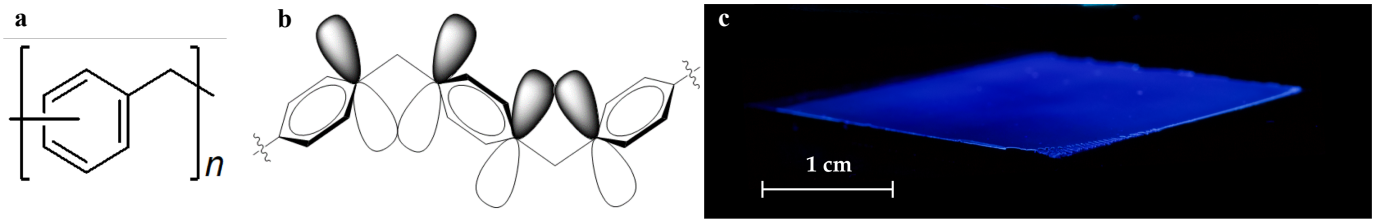


*Figure 1 (a) Chemical structure of poly(phenylene methylene) (PPM); (b) Schematic representation of homoconjugation in PPM as a result of overlapping p-orbitals of phenylene rings which are separated by a methylene group; (c) PPM coating containing polybenzylsiloxanes and benzyl buthyl phthalate, 2 weeks after hot-pressing.*

[1] Braendle, A.; Perevedentsev, A.; Cheetham, N.J.; Stavrinou, P.N.; Schachner, J.A.; Mösch-Zanetti, N.C.; Niederberger, M.; Caseri, W.R., *J. Polym. Sci. B Polym. Phys.* **2017**, *55*, 707.
[2] D'Elia M.F.; Breandle A.; Schweizer T.B.; Ortenzi M.A.; Trasatti S.P.; Niederberger M.; Caseri W.R., *Coatings,* **2018,** *8*, 274.