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Wojciech Kucharczyk, Damian Dusiński, Wojciech Żurowski, Robert Gumiński

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Wojciech KUCHARCZYK [a*], Damian DUSIŃSKI [b], Wojciech ŻUROWSKI [c], Robert GUMIŃSKI [d]

[a*, c, d] Kazimierz Pulaski University of Technology and Humanities in Radom, Faculty of Mechanical Engineering, Krasickiego 54B Str., 26-600 Radom, Poland

[b] Trend Glass Co., Zubrzyckiego 11 Str., 26-600 Radom, Poland

[a*] wojciech.kucharczyk@uthrad.pl, tel. + 48 48 3617680,
[b] ddusin@vp.pl, tel. +48 48 3689060, [c] wojciech.zurowski@uthrad.pl, tel. + 48 48 3617050,
[d] robert.guminski@uthrad.pl, tel. + 48 48 3617680

Abstract: The present work investigates ablative and thermoprotective properties of epoxy resins modified with expanded perlite (vermiculite – 3% or 10% of weight share). The properties of two epoxy resins (Epidian 52 and Epidian 601 cured with triethylenetetraamine – hardener Z-1 or cured with hardener TFF – triethylenetetraamine with phenol) were studied. Statistical methods for planning experiments were used and the effect of components on thermoprotective properties of epoxy composites was established. The maximal temperature of the rear surface of an ablative sample and an average relative ablative (erosive) mass loss after 120 s of the heat flux exposition were analysed. It was shown that the best of both thermoprotective properties, i.e low temperature of the rear surface area and low ablative mass loss (the highest thermal stability), were achieved by the composite based on Epidian 601 cured with hardener Z-1 and containing 10% mass of vermiculite. More stabilized ablative layer with limited erosion was obtained with a higher vermiculite participation (especially with Epidian 52 + TFF). Moreover, the type Z-1 of epoxy hardener showed the most significant effect on the maximum temperature of the rear surface area. Triethylenetetraamine hardener Z-1 decreases this temperature.

***Key words*:** epoxy resins, expanded perlite (vermiculite), ablative properties, thermoprotective properties

1. Introduction

The objective of this study was to evaluate ablative and thermoprotective properties of epoxy composites filled with expanded perlite (vermiculite). In particular, the study was aimed to determine quantitative and qualitative effects of proportion of the components with regard to their application in thermoprotective coatings for machinery and equipment, parts of structures and rooms exposed to fire hazards, short-term impact of high-temperature heat fluxes. Such situation may take place, for instance, as a result of terrorist attacks (1995 – Murrah Federal Building in Oklahoma City, 2001.09.11 – WTC in New York [1]) or explosions of inflammable materials (fires in the Alps tunnels: St. Gotthard, St. Bernard, the tunnel under the Mont Blanc between 1999 and 2001 [2]).

ITA (International Tunneling Association) recommends that the fire-resistant covers of fire-safety systems in tunnels should limit temperature growth of concrete to 350°C [2, 3] (higher temperatures reduce concrete rigidity even below 50% of its nominal values [4]) and protect it against flaking and peeling. The steel structural elements must not exceed 300°C [2], as tensile strength and rigidity of steel diminish rapidly at higher temperatures. Carbon