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ABSTRACT OF THE DISSERTATION
„Influence of graphene oxide functionalization on the properties of ceramic suspensions and obtained ceramic – graphene composites"

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In the technology of ceramic and composite materials an increasing emphasis is put on the use of colloidal processing. These techniques allow for better control over the distribution of the reinforcing phase in the matrix compared to die pressing methods. The application of colloidal processing in the case of ceramic – graphene composites may additionally allow to avoid the drying stage of graphene oxide which is one of the main factors responsible for its agglomeration. Aqueous ceramic – graphene oxide colloidal systems are characterized by high viscosity and a tendency to agglomerate (especially for high graphene oxide content). These problems make it difficult to prepare the suspensions with a high content of well dispersed graphene oxide. The application of aqueous colloidal processing methods in fabrication of ceramic – graphene composites is not well described in the scientific literature. For this reason, it is especially important to elaborate solutions which would allow shaping of ceramic – graphene materials through colloidal methods.

The aim of the research was to develop a chemical functionalization of graphene oxide aimed at the improvement of its dispersion degree in multiphase colloidal systems used in shaping of ceramic – graphene composites as well as determination of interactions between graphene oxide (GO) and functionalized graphene oxide (f-GO) with other components of the suspensions. The additional application goal of the research was to obtain ceramic – graphene samples by slip casting, gelcasting and tape casting methods and pressureless sintering in a nonoxidizing atmosphere.

In the research a suspension of graphene oxide with a concentration of 4.5 g/dm^3 was used as one of the suspensions' components and precursor of graphene in the obtained composites. Graphene oxide was subjected to the chemical functionalization process. The procedure was to add glucosamine to the carboxyl groups present on the surface of the graphene oxide through the nucleophilic substitution reaction. Analysis of FT-IR and Raman spectra and elemental analysis confirmed that the proposed functionalization was effective. Additionally, the results of particle size distribution and rheological properties of non-functionalized (GO) and functionalized (f-GO) graphene oxide proved that suspensions of f-GO are much less agglomerated.

In the research two ceramic powders were used: ZrO_2 (TZ-PX-245) of a mean particle size of 40 nm and Al_2O_3 (TM-DAR) of a mean particle size of 120 nm. Both of them were used as one of the suspensions' components. A number of dispersing agents were used in the research: diammonium hydrocitrate, polyethyleneimine, Duramax D-3005, glucuronic acid and lactobionic acid. The zeta potential in function of pH for ceramic powders and graphene oxides was determined. In the case of ceramic powders, this relationship was determined for samples with the addition of the abovementioned