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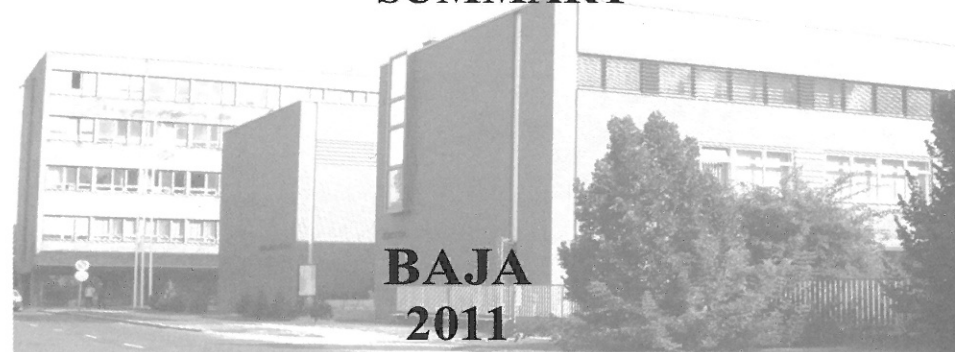
Eötvös József Főiskola

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Műszaki és
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SUMMARY



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Evaluation of stiffness properties of highly branched, partially cross-linked PVC

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The application area of rigid PVC can be extended by the modification of its molecular structure; e.g. copolymerization, branching or partial cross-linking.

Researchers of BorsodChem Zrt. (Kazincbarcika) have developed the ONGROVIL(R)SH-700 type PVC resin, which is a partially cross-linked polymer. This resin is mostly used for surface modification of rigid PVC sheets and plates mixed with traditional PVC of linear molecular structure.

This way a so called homologous polymer blend is formed being similar to the polyethylene of bimodal molecular weight distribution used in the PE pipes. This structure improves both the ease of processing and the excellent mechanical properties.

The unmodified rigid PVC is a brittle plastic even at room temperature therefore to improve its ductility polymer additives, so called impact modifiers are used.

During the experiments with the ONGROVIL(R) SH-700 it has been observed that adding small quantities of highly branched PVC resin alters the fracture behavior of this PVC type significantly, characterized by the critical stress intensity factor (K_{Ic}) and the critical crack propagation energy (G_c).

We introduced a test method for the determination of the above mentioned parameters and measured their dependence on additive concentration. Fracture surfaces were investigated using scanning electron microscopy and the analysis of the fractured surfaces revealed that the highly branched PVC caused changes in the mechanism of fracture.

The obtained results also have industrial importance. Beyond the expected surface modification the impact properties of the film products are significantly improved.

3.2. MATERIAL SCIENCE, MATERIAL TESTING

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Purpose of our experimental studies was to analyze the influence of silica fume on the fire resistance of concrete, because earlier studies did not give enough guidance. We carried out our experimental studies at the Department of Construction Materials and Engineering Geology at Budapest University of Technology and Economics.

Laboratory experiments were carried out by using various amounts of silica fume and the water-to-cement ratio on cement cubes. We analyzed mixtures with a water-to-cement ratio of 0.30, 0.35 and 0.40 and with a silica fume content of 0 m_c%, 1 m_c%, 3 m_c%, 6 m_c%, 9 m_c%, and 15 m_c%. Samples were subjected to heat loading of 20°C, 50°C, 150°C, 300°C, 500°C, and 1000°C. After cooling down the specimens to room temperature we examined the compressive strength of the samples. We reached the conclusion that silica fume raises the relative remaining strength after heat loading.

We used the results of the experiments with cement cubes to define the experimental parameters by **concrete samples**. We considered the mixtures used in practice and the currently valid standards. The Hungarian standard does not allow to use more than 10 m_c% of silica fume in concrete mixtures. After considering our results and the ability of workability, we decided to use a water-to-cement ratio of 0.35 in our further experiments. Nevertheless, we prepared our tests on concrete mixtures with a silica fume content of 0 m_c%, 3 m_c%, and 9 m_c%.

In the next step of our experiments we prepared 6 different concrete mixtures. To our tests cylindrical and prism-shaped samples were needed. The use of different shapes enabled us to observe the shape-effect as well. We noticed that the resistance of the prisms to heat load increases with the increase of the silica fume content. In case of 0 m_c% silica fume content, all the prisms broke during the heat loading, while in case of higher silica fume content they remained intact. The concrete samples were subjected to a heat loading of 20°C, 50°C, 150°C, 300°C, 500°C and 1000 °C. After cooling down to room temperature we measured the flexural strength of the prisms and the compressive strength of the cylinders.

At the end of our experiments we can draw the following conclusions:

- Risk of explosive spalling of concrete decreases with the increase of the silica fume content.
- Regarding fire resistance, it was proved to be more favourable to substitute some part of cement with silica fume (regarding both the remaining compressive strength and the remaining flexural strength).

Our test results could give guidelines on increasing the fire resistance.