

Modified approach to the use of material in plastics

Established in 2000 as plastic profile manufacturing company, ATi Profil Ltd. has more than 100 different plastic profiles in their product range, plus custom models created in collaboration with the company' clients. Currently the share of recycled raw material is up to 30%, thus securing the balance between green attitude and quality of production, www.atiprofil.ee

ATi Profil

Industrial need

The company searched for research services in order to get a Mohs scale measurement result for the fine powder burnt oil shale product, which could be used as a filler material in the plastics. This would be possible if current plastics manufacturers were provided with comparative abrasiveness values of this new substance in comparison with currently used filler materials.

How useful was it to get research support?

ATi Profil had long been looking for an experiment which would provide them with the improved knowledge about the Mohs and Vickers hardness of the burnt oil shale ash fractions. The obtained hardness value will be applied by the company when adding it to the safety datasheet of the ash and thereby improving the knowledge of plastics manufacturers on how much abrasion wear is expected to the machinery while using oil shale ash as a filler

material. Through the research the company has received the useful reference values that will be used when inserting data about the recycled filler material in the plastics. Additionally, the establishment of a trustful dialogue with the analytical research facilities at academia has been of great value for receiving the desired results and as an excellent preparation for a continued collaboration in developing the company's products.

Technique

The methodology for Mohs testing was elaborated. It consisted of scraping the surfaces of the four first Mohs minerals with a metal file, followed by treatment with the three fractions of oil shale ash to remove the markings on surfaces of Mohs minerals. The markings were removed by ash powder only in case if it had higher hardness than the Mohs mineral. The technique for Vickers testing used micro-indenting on this

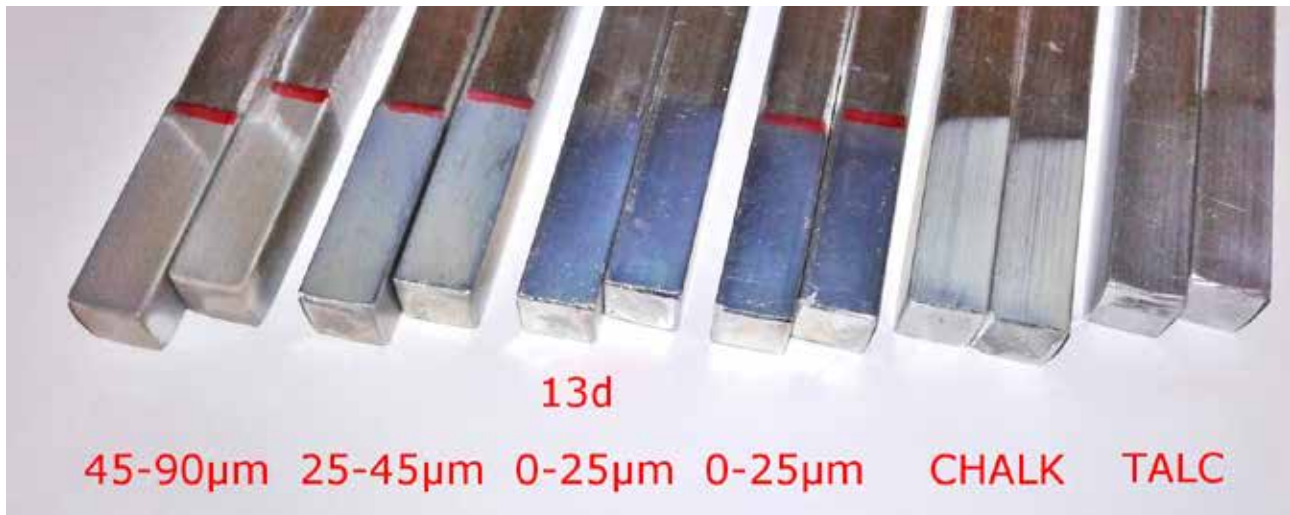


Figure. The image of the aluminium rods after the abrasion experiments

surface providing the hardness value. The samples were produced by spark plasma sintering of oil shale ash into a small ceramic pellet. The abrasion value was recorded in the experiment, where aluminium rods were moved in a special mill/grinder with a constant force for up to thirteen consequent days, and then the mass loss of the aluminium rods was determined.

Experiment

The experiment aimed at studying the hardness and abrasiveness of burnt oil shale ash, sieved into different fractions and comparing these results with commonly used filler materials of plastics. In the first phase the research study included scratch testing Mohs scale minerals with three fractions of burnt oil shale ash powder and determining the hardness value of the ash. Thereafter the aluminium rods were mechanically moved inside the powder for several hours or even days, the

mass loss of aluminium rods, being removed by the abrasion, were determined. The study resulted in the establishment of a relationship between the Mohs hardness, the Vickers hardness and the abrasiveness of the filler material studied.

Any other implications?

It should be underlined that the hardness of oil shale ash powder, commonly considered as waste, can now be used as a filler material in plastics when values of important parameters were identified. It implies that the findings of the experiment are significant from the technology and environmental point of view, thus making the conducted research unique by providing values of hardness not available before. The implication of the experiment is related to the environmentally fundamental approach of using resources more efficiently through material recycling.