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Surface sealed light weight aggregate from mine tailings

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Traditionally manufactured light-weight aggregates (LWA) suffer from a fractured surface. Consequently, concrete mixes containing LWA cannot be pumped, due to the water being forced into the porous LWA pellets by the pumping pressure. This is a limitation and a cost factor in construction practise. As part of the project "Nye produkter fra gruveavfall i nord" (Novel products from mine tailings in Northern Norway), will examine mine tailings aiming to develop new products. A pilot study has aimed to develop high quality LWA suitable for pumping from Nussir mining company tailings. In 2019, Nussir ASA was granted operational licence for exploitation of the Repparfjord copper deposit in northern Norway. The tailings, 30 Mtons in total and 1-2 Mtons per year, is deposited in sea.

LWA is traditionally made from pelletized clays, where (Na, K, Mg, Ca, Fe)-aluminosilicates are heated to a viscous glassy phase and subsequently bloated by carbothermal reduction of Fe(III)-oxide, developing carbon monoxide gas inside the pellets. The pellets are then quenched in air, and this is the stage where the surface is fractured. In the pilot study, mine tailings lower in sodium and potassium have been identified, aiming to increase the thermal shock resistance enabling a non-fractured pellets surface. Experimental work was carried out by placing the pellets in a preheated furnace, subsequently quenching pellets at different predetermined times. The results from the study showed that it was possible to produce an unfractured surface, but work is still needed to optimise the bloating. The pellets had an optimal bloating temperature of 1225 °C which is almost 100 °C higher than for typical clay LWAs. Exposure time was ca 5 minutes, a bit shorter than traditional LWAs. The main project will continue the work with a series of new tailings, varying in both composition and particle size.