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Influence of crushed aggregate fines with micro-proportioned particle size distributions on rheology of cement paste

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Abstract: This paper presents a study on how crushed concrete aggregate fines affect rheological properties of cement paste. The fines (≤ 250 µm) were produced by high-speed vertical shaft impact (VSI) crushing of rock types from 10 different quarries representing a wide range of local Norwegian geological variety with respect to rocks of different mineralogy and mechanical properties (mono- and multimineralic igneous (intrusive and extrusive), metamorphic and sedimentary rocks). The results show that the rheological properties of cement paste are governed mainly by the specific surface of the fines calculated from SediGraph measurements, and their surface properties causing different interaction with the superplasticiser (SP) molecules, as detected by zeta potential measurements. The rheology of cement paste is proportional to the specific surface and can be controlled by both altering particle size distribution (PSD) and volume fraction of crushed fines. The effect depends on the SP dosage and total surface of the fines present in the mix. The effect of the shape of the VSI crushed fine particles is of less importance at constant PSD for the materials studied here, because VSI crushing effectively normalised the equi-dimensionality of the grains, *i.e.* created similar particle shapes.

Keywords: Crushed sand, crushed aggregate fines, specific surface, zeta potential, cement paste, rheology.