

## *Use of Oscillatory Shear to Study the Effect of Limestone Filler on the Rheology of Early-Age Portland Cement*

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Cement is a material that has been in use since the ancient times and is the most widely manufactured material in industry today. During the production of cement, limestone undergoes a process called calcination which releases  $\text{CO}_2$ . In order to reduce the environmental impact and cost of cement production it has become standard practice to replace a portion of the cement mixture with ground limestone, but this causes a change in the rheological profile of the mixture. This change in rheology affects both the short and long term workability of the material. In this study, small amplitude oscillatory shear (SAOS) was used to characterize the rheology of cement mixtures with a water to cement ratio (w/c) of .42. The tested samples were unaltered cement, cement blended with coarse limestone ( $10.8 \mu\text{m}$ ), and cement blended with fine limestone ( $1.3 \mu\text{m}$ ). The evolution of  $G'$  and  $G''$  was tracked during the early stages of cement setting. Results of the study show that the storage ( $G'$ ) and loss ( $G''$ ) moduli increase as the limestone particle size is made smaller than the cement particle size. Tests also show that cement pastes exhibit greater shrinkage with the finer particles.