Simulation and Optimization of the Speed Flow in COMSOL Multiphysics® During the Suction of the Dust Pump for Granite Polishing Operation

B. Wenga¹, J. Kouam¹, A. Djebara², A. Bahloul², V. Songmene¹

¹École de Technologie Supérieure, Verdun, Montreal, QC, Canada
²Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), Montreal, QC, Canada

Abstract

Polishing is one of the oldest finishing processes that are necessary because of the commercial value given to aesthetics in the construction product. Several companies in Quebec (Estrie region) are deployed in the finishing sector where single had in 2009 have sailing in about 14,000 tons of granite to a turnover of 1.5 million $ CAD. This favorable economic growth in this sector greatly obstructs polishing worker's conditions where the exposure to emissions of crystalline silica dust is so high. Some toxicological studies are identified this pollutant responsible of a particular type of lung cancer: silicosis. The protection of workers is at the center of the concerns of stakeholders (CSST, Industries, IRSST and Universities). The scientific interest is shifting to the systematic study of the polishing "process" to find operational solutions to the intrinsic reduction or reducing near-field emissions of fine and ultrafine dust. Measure the total concentrations of dust emitted by polishing of granite was more important in the evaluation of workers' exposure to crystalline silica as quartz in these industries.

In general, granite dust emitted during polishing is high concentrations and sampling equipment as DUSTTRAK, SMPS, APS does not allow measurements in such conditions. Therefore, we must develop a dilution system to better sampling. Moreover, it has been shown by researchers in air quality when the dust extraction polishing system creates excess turbulence in the flow, and then there is a significant loss of granite particles in the diphasic flow. That was the reason of the bad measurement given by sampling devices in air quality. In the project, we will use COMSOL Multiphysics for simulating flow in the dust extraction during polishing of granite. We used the Navier-Stokes equations to model the flow and the k-Ɛ numerical method to graphically simulate the flow. It was clear from our results that for flow velocities 0.2 to 1.5 m/s the air quality sampling devices gave the good result.


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