Modelling and predicting flotation froth stability

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The performance of flotation cells is highly dependent on the behaviour of the froth phase. The phenomena taking place in the froth not only control the water that reports to the concentrate, and thus the entrainment of gangue material, but also have a significant impact on the overall recovery. Changes in bubble size due to coalescence of bubbles in the froth and the bursting of bubbles at the froth surface depend on a number of operating parameters, the relationship between which is complex and difficult to model and predict.

The Advanced Mineral Processing Research Group at Imperial College has developed mathematical models that link various aspects relevant to froth flotation performance. While these models are based on froth physics, they require froth stability parameters as inputs. For a given froth stability, defined in terms of the fraction of air that leaves the cell as unburst bubbles, the aforementioned models can predict liquid flowrate, entrainment and froth recovery. More recently, the group has also studied more closely the relationship between the bursting flux at the top of the froth and the air flux into the cell. The effect that many other important flotation variables have on froth stability is still to be formulated into models. Such models must also be validated using appropriate data, which is not usually readily available from industrial data nor is always measured at the lab scale.

This project will contribute to enhancing our ability to predict froth stability by developing semi-empirical and theoretical models for bursting flux and the change in bubble size over the froth that take into account the effect of variables such as incoming bubble size, froth structure and froth depth. The models will be assessed and validated using a combination plant data, both historical and obtained on an ad hoc basis, as well as laboratory data that will be generated using a flotation bench scale system that can be operated at steady state. As part of the work, techniques will need to be developed to measure important parameters such as the change in bubble loading over the froth and its coupling to the evolution of the bubble size distribution.

This project is available for students who apply for Imperial College scholarships or other international scholarship schemes.

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