Birth, life and death of bubbles in high viscous glass-forming liquid

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The opening a sparkling or champagne bottle leads to nucleation, rising, grow and break-up of bubbles in the liquid. Same phenomena occur in a volcanic chamber. For both, the pressure decrease is the main mechanism leading to a dramatic decrease of volatile solubility. In industrial context and in particular in the glass melting process, similar phenomena are observed. Conversely to the two previous examples, here the pressure is quasi-constant. The bubble dynamics is mainly driven by the temperature. During the seminar, I will first speak about the "birth" of bubbles due to the heating of raw materials using in glass melting. The bubble population will be characterized in term of size distribution. Two situations will be detailed: surface bubble nucleation [1] and volume creation due to the heating of granular media of glass [2]. We will insist that at short time, the bubble coalescence is a main mechanism explaining the bubble size evolution.

Figure 1: Bubbles in a glass-forming liquid.

The grow or shrinkage, i.e. the "life", of bubbles will then summarize. The purpose of this part will be to pinpoint that the oxidation-reduction reaction of multivalent species like iron in glass-forming liquid plays an important role in the mass transfer [3, 4]. Finally, the "death" of bubble will be presented using experimental set-up [5] and numerical method [6]. Mainly, the drainage of the liquid film created between the free surface of the liquid bath and a bubble just beneath the free surface will be analysed. We will show that the dynamics of liquid film is mainly driven by the bubble size or more accurately by the Bond number.

References

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