

## Full model

- Solid and liquid phase densities are equal and constant.
- Solid and liquid phase thermal conductivity and heat capacity are equal and constant.
- 14 non dimensional parameters.

### Thermally ideal model

- Neglect gas fraction in heat equation  $\phi_g \ll 1$  and  $v_g = 1$ .
- 13 non dimensional parameters

### Incompressible model

- Neglect variations in gas density driven by thermal expansion, dynamic pressure variations, hydrostatic pressure variations, and Laplace pressure jump.
- $\frac{\theta}{\theta_K}, \frac{p_H}{p_0}, \mathcal{H}Z, \text{La} \ll 1$ .
- 10 non dimensional parameters.

## Reduced model

- Incompressible and thermally ideal.
- Assume space occupied by gas is negligible  $\omega_\infty \chi \ll 1$ .
- Neglect terms of  $O(\phi_g) = O(\chi)$ .
- This implies  $W_l = 0$ ,  $p_H = 0$ , and  $\phi_s + \phi_l = 1$ .
- 9 non dimensional parameters.

## Instant nucleation model

- Additionally assume that nucleation timescale is much faster than solidification and flow  $\text{Da} \rightarrow \infty$ .
- System is either subsaturated with dissolved gas and  $\phi_g = 0$ , or  $\omega = 1$ .
- 8 non dimensional parameters.