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Nonlinear boundary value problem of the meniscus for the terrestrial dewetted Bridgman crystal growth technique.

Dewetted Bridgman is a crystal growth technique in which the crystal is detached from the crucible wall by a liquid free surface at the level of the solid-liquid interface, called liquid meniscus, which creates a gap between the crystal and the ampoule. Dewetting phenomenon was first obtained spontaneously in spatial experiments, and opened the possibility to reproduce experiments on the earth - obtained by applying a gas pressure difference $\Delta P = P_{cold} - P_{hot}$ between the cold and hot sides of the sample. In order to understand the process which leads to a crystal with a constant radius on the ground, the static stability of menisci is analyzed. For this aim, starting from the Young-Laplace equation of a capillary surface in equilibrium in the presence of gas pressure, the corresponding nonlinear boundary value problem having three boundary conditions is considered. Because our interest is in the statically stable menisci, the conditions for which the solutions of BVP minimize the total energy functional of the melt column, are searched. In this way, inequalities representing necessary or sufficient conditions for the existence of the convex (or convex-concave) solutions of the considered BVP, are established. Numerical illustrations are given for two semiconductors. (Received September 11, 2008)