1011-35-16 **Ivan Blank** and **Marianne Korten*** (`marianne@math.ksu.edu`), Department of Mathematics, Kansas State University, 138 Cardwell Hall, Manhattan, KS 66506-2606, and **Charles Moore**.

Existence, uniqueness and regularity of the free boundary in the Hele-Shaw problem with a degenerate phase.

The Hele-Shaw model describes the flow of a viscous fluid being injected through the slot G between two nearby plates. It is used in injection molding, in electromechanical machining, and to study the diffusion of nutrients and medicines within certain tumors.

We obtain the unique weak solution (u^∞, V) to the Hele-Shaw problem with a mushy zone $0 < u^\infty < 1$,

$$u_t^\infty = \Delta V \text{ in } G^c \times (0, +\infty),\ u^\infty(x, 0) = u_I(x),\ V(x, t) = p(x) \text{ in } \partial G \times (0, +\infty),$$

as the (pointwise) "Mesa" type limit of $(u^{(m)}, m(u^{(m)} - 1)_+)$, where the $u^{(m)}$ are solutions to one-phase Stefan problems with increasing diffusivities, $u_t^{(m)} = \Delta(u^{(m)} - 1)+$, with fixed initial and boundary data $0 \le u_I \le 1$ and $p(x) > 0$. The slot $G \subset I\!R^n$ does not need to be connected.

Further, we obtain the traditional formulation (by means of the Baiocchi transformation) as an obstacle problem. At this point regularity in space follows from the work of Blank and Caffarelli. (Received August 04, 2005)