small (*Solomatov*, 1995). Convection in a non-Newtonian fluid with a temperature- and strain rate-depdendent rheology is always a finite-amplitude instability, and cannot be readily analyzed analytically (*Solomatov*, 1995).

Analysis of the onset of convection in a fluid with stress-dependent (but not temperature-dependent) rheology can provide constraints on how the non-Newtonian behavior affects Ra_{cr}. An alternative method of determining Ra_{cr} for a non-Newtonian fluid stems from a physical argument put forth by *Chandrasekhar* (1961), who postulated that the critical Rayleigh number occured at a critical temperature gradient where the dissipation of energy by viscous forces in the system exactly balanced the release of energy from the rising, thermally buoyant plume. Using an energy balance argument, *Tien et al.* (1969) were able to calculate the critical Rayleigh number for non-Newtonian fluids with a range of values of stress exponent, which compared favorably to their laboratory measurements of critical Rayleigh number for fluids with stress-dependent rheologies.

The most widely-used results for the critical Rayleigh number for convection in a non-Newtonian fluid arise from the pivotal study of *Solomatov* (1995), who built upon the analysis of *Tien et al.* (1969) plus additional studies by *Ozoe and Churchill* (1972) to consider a stress- and temperature-dependent rheology. With the knowledge that the critical Rayleigh number for a non-Newtonian fluid depends on initial conditions, *Solomatov* (1995) characterized the value of Rayleigh number where convection could not occur, regardless of initial conditions.

Unlike terrestrial planets, icy satellites can potentially receive bursts of heat due to tidal dissipation relatively late in their evolutionary histories. If an ice shell is convecting when tidal dissipation begins, and the heat generated within the ice exceeds the maximum convective heat flux, which is controlled by the rheology of ice, the shell will melt at its base and thin. If the layer thickness drops below a critical value, convection will cease. The value of critical layer thickness where convection is no longer possible