

## Grain Selection in Spiral Grain Selectors during Casting Single-Crystal Turbine Blades

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**Abstract :** Single crystal components manufactured using Ni-base Superalloys are routinely used in the hot sections of aero engines and industrial gas turbines due to their outstanding high temperature strength, toughness and resistance to degradation in corrosive and oxidative environments. To control the quality of the single crystal turbine blades, particular attention has been paid to grain selection, which is used to obtain the single crystal morphology from a plethora of columnar grains. For this purpose, different designs of grain selectors are employed and the most common type is the spiral grain selector. A typical spiral grain selector includes a starter block and a spiral (helix) located above. It has been found that the grains with orientation well aligned to the thermal gradient survive in the starter block by competitive grain growth while the selection of the single crystal grain occurs in the spiral part. In the present study, 2D spiral selectors with different geometries were designed and produced using a state-of-the-art Bridgeman Directional Solidification casting furnace to investigate the competitive growth during grain selection in 2d grain selectors. The principal advantage of using a 2-D selector is to facilitate the wax injection process in investment casting by enabling significant degree of automation. The automation within the process can be derived by producing 2D grain selector wax patterns parts using a split die (metal mold model) coupled with wax injection stage. This will not only produce the part with high accuracy but also at an acceptable production rate.

**Keywords :** grain selector, single crystal, directional solidification, CMSX-4 superalloys, investment casting

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