ABB Slab Strand ElectroMagnetic Stirrers (SEMS) are mainly used for ferritic stainless and silicon steels. However, beneficial effects on centerline segregation and halfway cracks are also achieved on carbon grades. ABB is the leading supplier of Electromagnetic Equipment for continuous casters and has supplied slab SEMS to over 50 strands worldwide.

**Ferritic stainless steels**
These steels solidify with a ferritic structure that does not or only partially undergo phase transformation during solidification or during rolling/heat treatment. The primary coarse solidification structure results in a rough surface of the final product after rolling. This surface problem is known as ridging or roping. A SEMS will change the initial coarse columnar grains to a more fine-grained equiaxed structure, thereby reducing ridging and roping. A newly developed, significantly stronger stirrer results in an equiaxed ratio normally above 50% for most superheats and casting speeds, see figure to the right.

**Silicon steels** (electrical steel sheets)
The ferritic structure in silicon steel is very sensitive to grain growth. As non-oriented steel shall have isotropic magnetic properties, the solidification structure must be fine-grained and that will be ensured by using SEMS, see figures below.

**Centerline segregation**
Strand EMS results in a large percentage of equiaxed solidification structure, resulting in a reduced centerline segregation.

**Halfway cracks**
Cracks halfway between the surface and the middle of the slab are caused by too high stress from cooling and bending/unbending related to the strength of the solidification structure. A SEMS gives a more equiaxed structure thereby reducing halfway cracks by limiting crack propagation.
The ABB SEMS (box-type) is placed behind strand support rollers allowing the strand support and strand spray cooling to remain unchanged. The support rollers immediately in front of the stirrer are made of austenitic non-magnetic stainless steel. The stirrer can be placed in a caster segment and go in and out of the caster with the segment (internal mounting) or be attached to a manipulator in the cooling chamber and retracted from the strand at segment exchange (external mounting, see drawing above).

The powerful stirrer operates at low frequency to ensure good penetration through the strand. As a result, all steel in front of the stirrer is accelerated towards the slab narrow side (transversal stirring). The re-circulating flow will then form two loops, one above and one below the stirrer, see figure above. This results in a long stirred length in the slab with good turbulence mixing of the steel, thus promoting the formation of an equiaxed structure.

With ABB’s powerful box-type design only one stirrer is needed.

For caster revamps and especially for silicon steel ABB has developed a SEMS type EM Roll. It consists normally of four stirrers inside supporting rolls, see figure to the right. This design may result in less changes to the caster.