MANUFACTURING RADIAL PLATES BY MEANS OF HIPPING AND A HYBRID MACHINING CENTRE

H. Wu[1], H. Handroos[1], P. Pela[2], J.T. Lehtonen[3]

[1] *Lappeenranta university of technology*
[2] *Tekes, Finland*
[3] *Metso Ltd. Finland*
Corresponding author: huapeng@lut.fi

The radial plates (RPs) are D-shaped stainless steel plates for the ITER toroidal field coils (Fig. 1), profiled to contain on each side the spiral grooves, where the insulated conductor is inserted. The grooves are reflecting of the winding pack. For each coil there are five regular RPs and two side-RPs. RP with the inserted and insulated conductor is called a double pancake. The sizes of plates are about 14×9 m. The ITER team has investigated machining methods for cutting groove, e.g., a large milling machine, hot extrusion and welding. All those methods are either time-consuming or expensive.

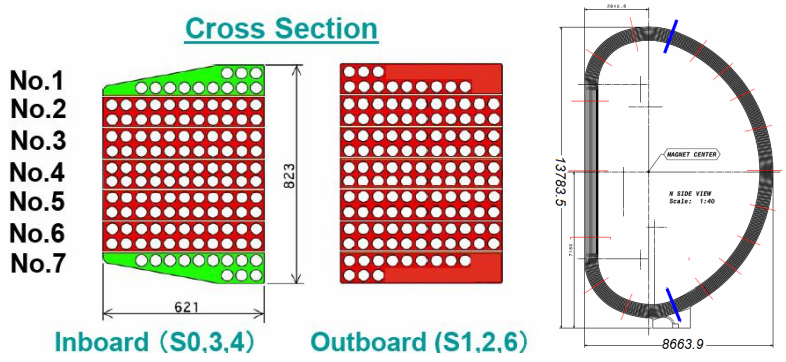

Figure 1: Radial plate

This paper presents a new efficient method for manufacturing RPs. The method combines the hot isostatic pressing (HIPping) process and a hybrid parallel robot machine. HIPping is a hot pressing process in which a material is subjected to high temperature, and pressure applied equally from all sides. The HIPing process can densify powder or preformed material to 100% of theoretical density. The productive cycle of HiPping is much faster than other methods. However, as the limited can size, the final plate has to be made in twenty pieces and the final welding and machining are need.

To avoid building a big milling machine and to save cost, parallel kinematics machine tool is one good solution. The parallel kinematical mechanism offers manufacturer a number of advantages, such as a higher stiffness-to-mass ratio, higher speed, higher accuracy, reduced installation requirements, and mechanical simplicity.

The detailed analysis of the machining process and the hybrid parallel robot mobile machine is given; the process includes sector-HIPping, sector-machining, sector-welding and final welded-seam-machining. Results show that the hybrid parallel mobile machine center offers a better solution for machining radial plate.