# Numerical studies of post weld heat treatment on residual stress of impeller

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## Abstract

As the key component of compressor and centrifuge, impeller has been widely used in chemical and nuclear industries. The blade is generally jointed to the turbine disk by TIG, MIG, laser welding, etc. The input heat can lead to the formation of residual stress, which can obviously affect crack formation and crack growth on the jointed blade. The residual stress can also affect the corrosion and the erosion process in the service life of the impeller. So, the controlling of residual stress on impeller is very important for the impeller design. A sequentially coupled thermomechanical model [Zhang et al., 2014; Zhang et al., 2015] is used to simulate the residual stress of the welded impeller. The material near the weld toe can be heated during the TIG process of the impeller, as shown in Fig.1.


Fig.1 Temperature rises in impeller

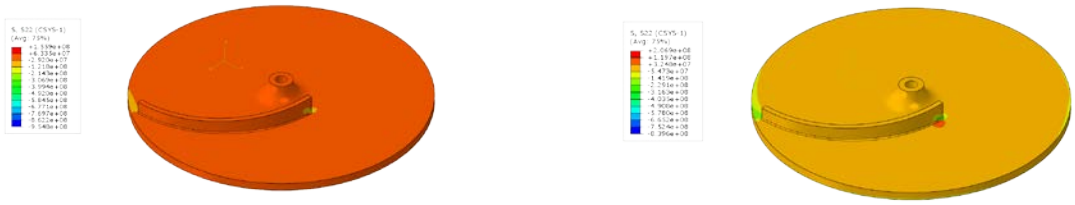
The welding temperature can lead to the formation of residual stresses on the blade, as shown in Fig.2. The residual stress along the weld is obviously higher than the one perpendicular to the weld. The residual stress on the surface of the impeller blade is much higher than the one at other locations.

Along the weld

Perpendicular to the weld

Fig.2 Residual stress of impeller blade

The post weld heat treatment temperature can directly affect the final residual stress distributions, as shown in Fig.3. It can be seen that a temperature of 800℃ is appropriate to minimize the residual stress of the impeller. This phenomenon is different to the one observed on plate weld.



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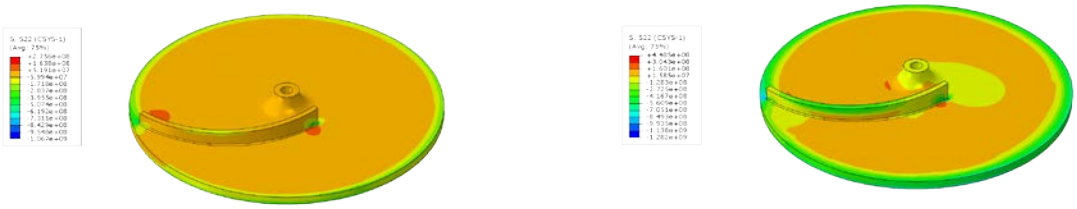

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Fig.3 Effect of post weld heat treatment temperature on residual stress

**Keywords:** Impeller, Sequentially coupled thermomechanical model, Residual stress, Post weld heat treatment.

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