

## 6 - 12 The Progress of the Demonstration Application of SIMP Steel

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Lead cooled fast reactor (LFR) is considered as an innovative nuclear energy system, which has attracted attention worldwide in recent years<sup>[1]</sup>. The LFR was also chosen as the sub-critical reactor in the China initiative Accelerator Driven System (CiADS). LFRs present an extreme environments in which structural materials (mainly FeCr base steels) are required to withstand intense neutron radiation and coolant corrosion in a wide temperature range. Material issues are therefore considered to be one of the main challenges in the development of LFRs. For the extreme harsh operating conditions of LFR, *e.g.* high temperature, intense irradiation and aggressive corrosion, etc., a novel martensitic steel (SIMP) with addition of Si has been developed under the collaboration of Institute of Modern Physics (IMP) and Institute of Metal Research (IMR)<sup>[2]</sup>. The smelting of 5 ton SIMP steel was successfully achieved in 2016, which marks this material has meet the requirement of industrial application. Meanwhile, a database of SIMP steel has been established, including basic mechanical properties, corrosion and irradiation, *etc.* Based on the progress of SIMP steel, a “three-stage” plan for the demonstration application was made. The first stage is to design and develop a SIMP- exchanger prototype which will be used in liquid lead bismuth. So far, the engineering design of the prototype has been completed (Fig. 1), and the exchanger tubes are being processed (Fig. 2). The SIMP-exchanger prototype will be completed by the end of this year.

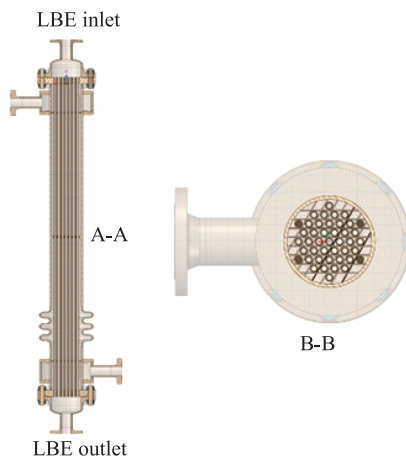


Fig. 1 (color online) Schematic of SIMP-exchanger prototype.



Fig. 2 (color online) Billet tubes of the SIMP-exchanger after hot piercing.

### References

- [1] Alessandro Alemberti, Valery Smirnov, Craig F. Smith, et al., Overview of lead-cooled fast reactor activities, *Progress in Nuclear Energy*, 77(2014)300.
- [2] K. Yang, W. Yan, Z. G. Wang, et al., *Acta Metallurgica Sinica*, 52(2016)1207. (in Chinese).