Editorial for special issue on USTB–RWTH Aachen’s 40 years of collaboration

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The year of 2019 is the 40th anniversary of the signing of the inter-school collaboration agreement between University of Science and Technology Beijing (USTB) and RWTH Aachen University. It is also the first friendly inter-school collaboration agreement signed between domestic universities and foreign universities after China's reform and opening-up. In order to commemorate this important historical event, the special academic issue is published in *International Journal of Minerals, Metallurgy and Materials* after friendly negotiation between RWTH Aachen and USTB. The special papers adopted the way of special invitation, mainly inviting: (1) famous professors in mining, metallurgy, and materials fields of the two universities; (2) young scholars who have studied in the two universities through the collaboration agreement between the two universities.

RWTH Aachen University is one of the members of IDEA league, a famous European Union of science and engineering university, and also a member of German elite universities. It has obvious advantages in metallurgy, materials, machinery, and other disciplines. USTB is one of the first batch of universities selected for the "211 Project" in China, and also one of the universities selected for the construction of national advantageous disciplines. Its metallurgy and materials disciplines enjoy a high reputation in the world. As the contact person of collaboration between USTB and RWTH Aachen University, I am honored to be the special editor of this commemorative academic special issue.

This special issue includes 14 papers, including 12 scientific research papers and 2 review papers. All papers were mainly focused on the research development in RWTH and USTB, as well as the frontiers topics of the two universities.

First of all, the studies of advanced materials are also included. Li and Luo [1] focused on the medium-Mn steels, reviewing their hot forming process and the application, pointing out the future researches should be targeted on the commercialization of hot forming of medium-Mn steels. Wang *et al.* [2] reviewed the effect of microstructure on corrosion be-

havior of ultra-high strength martensite steel, exploring the corrosion mechanisms of additive manufacturing ultra-high strength steels and the ideas for designing new ultra-high strength martensite steel. In RWTH, researches concerning the mechanical properties of high-manganese steels were co-operated with the Max Planck Institute for Iron Research. Bleck [3] from RWTH reported that the microstructures of high-manganese steels were characterized by the use of modern methods at the nm-scale. Besides, the high-manganese steels are affected by the strong interaction among the alloying elements as well as various crystal defects.

As the competitive research direction in USTB, a large amount of researchers devote to relevant topics concerning metallurgical process. Xu *et al.* [4] from USTB conducted a research about the effect of Al_2O_3 on the viscosity of $\text{CaO-SiO}_2\text{-Al}_2\text{O}_3\text{-MgO-Cr}_2\text{O}_3$ slags and reported that the viscosity of the slag increases gradually with the increase of the Al_2O_3 content within the range of 17wt% to 29wt%. Xiao *et al.* [5] proposed a new method to produce high-quality bearing steel by using Si/Mn deoxidization, which can significantly improve the fluidity of liquid steel and ensure satisfying fatigue life. Yu *et al.* [6] presented a novel approach of inter-critical heat treatment for microstructure tailoring. Gu *et al.* [7] conducted a numerical study of stress distribution and fatigue behavior in terms of the effect of voids adjacent to inclusions with finite element modeling simulations under different assumptions. Besides of smelting process, safety issue is also a key point which should be paid extra attention during ironmaking and steelmaking. Jin and Niu [8] studied the possibility of exploding when different coals were applied in blast furnace injection.

On the other hand, researches in RWTH also produce valuable results, especially in the aspect of researches on the performance of advanced materials. Guo *et al.* [9] studied the influences of hydrogen on mechanical properties and fracture behaviour of Fe–22Mn–0.6C twinning induced plasticity steel. Ma *et al.* [10] simulated the austenite reversion in a

medium-Mn alloy by the multiphase-field approach. The simulated microstructural morphology and phase transformation kinetics (indicated by the amount of phase) concurred well with experimental observations. Liu and Lian [11] discovered the stress-state dependence of the dynamic strain aging (DSA) effect on the deformation and fracture behavior of high-strength dual-phase steel at different deformation temperatures (25 to 400°C) and revealed the damage mechanisms under these various configurations, reporting that the stress state is contributing distinctly to the DSA effects in terms of both the magnitude of thermal hardening as well as the pattern of blue brittleness. Hytönen *et al.* [12] investigated the effect of the weld microstructure and inclusions on the brittle fracture initiation in a thermally aged ferritic high-nickel weld of a reactor pressure vessel head. Zhang and Zaefferer [13] carried out a systematic study to understand the influence of sample preparation methods on the nanoindentation results of ductile metals.

Besides, there are also breakthrough concerning material preparation. Wang *et al.* [14] successfully fabricated the (CoCrFeNi)₉₅Nb₅ high entropy alloy coatings on the substrate of Q235 steel by laser cladding technology, demonstrating fine controllability of high-performance high entropy alloy coating with laser cladding technology, offering guidance for laser cladding preparation of other CoCrFeNi-system HEA coatings.

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