HZDR invites applications for 4 PhD positions at the Department of Magnetohydrodynamics (MHD) of the Institute of Fluid Dynamics. For all positions we are looking for students with excellent skills and first experiences in the field of fluid mechanics. Prior knowledge of liquid metal MHD or CFD is welcome but not required. All positions will be available from 01.04.2016. The starting dates can be agreed upon individually. The employment contract is limited to three years. The weekly working time will be 75% of regular weekly working time according to the collective agreement TVöD. The salary is based on the collective agreement TVöD-Bund and will be in the range of 35000-40000 Euro per annum. The place of work is Dresden-Rossendorf.

**PhD position #1 (Vacancy Notice No. 67E/2015)**

Metal recovery from slags uses the top submerged lance technology (www.outotec.com) in which gas is injected into a slag melt via a submerged lance from above. In order to improve the energy and resource efficiency of the process, the announced position shall perform experimental modelling of this process. Extensive experiences exist at HZDR on the handling of the room-temperature model melt GaInSn. The work in frame of this position is a joint project of the Helmholtz Institute Freiberg (HIF) for Resource Technology with the Institute of Fluid Dynamics at HZDR which both belong to HZDR. The general goal is to bring together basic fluiddynamic methods with practically relevant resource technologies, and to transfer the results to industrial partners.

Requirements:
- completed university education (master degree) in the fields engineering, physics or process engineering
- knowledge in the field of fluid dynamics and measuring techniques for liquid metal flows
- knowledge in the field of metallurgy is preferable

Tasks:
- experimental modelling of the two-phase flow gas-slags using the room-temperature liquid metal GaInSn
- measurement of the gas bubbles and the flow in the melt using available ultrasonic and X-ray measurement techniques
- extension of the model experiments to include chemical reactions of the gas phase (oxygen added) with the metal melt and investigation of the mass transport of the resulting oxides. Alternatively injection of solid particles and measurement of their transport.

**PhD position #2 (Vacancy Notice No. 68E/2015)**

Fluid flow and the related heat and mass transfer occurring in the continuous casting of steel have a distinct influence on the efficiency of the process and the final product quality. Electromagnetic fields are already in use in the industry for the purpose of an efficient flow control. However, there is still a significant need of research for achieving a better understanding of the interaction between magnetic field and turbulent flow. Such knowledge is required for optimization of the process parameters. The PhD candidate shall conduct an experimental modeling of flow problems
related to continuous casting of steel using low-melting point metal alloys. At HZDR there exist corresponding experimental facilities (LIMMCAST program) as well as suitable techniques for liquid metal flow measurements.

Requirements:
- completed university education (master degree) in one of the following fields: fluid engineering, process engineering, foundry engineering or physics
- knowledge in the field of fluid dynamics and measuring techniques for liquid metal flows
- knowledge about metallurgical processes

Tasks:
- experimental modeling of fluid flow and related transfer processes in the LIMMCAST facilities at HZDR using low-melting point metal alloys (GaInSn, SnBi)
- application of ultrasonic techniques and inductive diagnostic methods for flow measurements
- investigations of single and multiphase flows
- investigations of the impact steady magnetic fields (electromagnetic brakes) and AC magnetic fields (electromagnetic stirrers) on the fluid flow

PhD position #3 (Vacancy Notice No. 69E/2015)

Metal recovery from slags uses the top submerged lance technology (www.outotec.com) in which gas is injected into a slag melt via a submerged lance from above. In order to improve the energy and resource efficiency of the process, the successful candidate for this position shall perform numerical simulations of this process. Extensive experiences exist at HZDR on the numerical simulation of complex two-phase flows. Experimental data and first numerical simulations of simplified water models are available from literature. The work in frame of this position is a joint project of the Helmholtz Institute Freiberg (HIF) for Resource Technology with the Institute of Fluid Dynamics at HZDR which both belong to HZDR. The general goal is to bring together basic fluiddynamic methods with practically relevant resource technologies, and to transfer the results to industrial partners.

Requirements:
- completed university education (master degree) in one of the following fields: fluid engineering, process engineering, foundry engineering or physics
- knowledge in the field of fluid dynamics and numerical simulation
- knowledge about metallurgical processes

Tasks:
- numerical simulation of a simplified water-air model using the Euler-Euler approach
- simulations for liquid metal model experiments which are performed in parallel by another PhD student
- transfer of the simulations to real slag melts in order to analyse dependencies on process parameters (geometry, submergence length, flow rates, etc.)
- extension to include chemical reactions of the gas phase with the slag melt and/or the transport of solid particles in the melt

PhD position #4 (Vacancy Notice No. 70E/2015)

Metallic melts in industrial processes usually contain fine-dispersed particles (for instance oxides), which could have a detrimental effect on the mechanical properties of the final product. Such particles can be extracted by flotation. For that purpose gas bubbles will be injected into the melt in order to collect the impurities at the gas-liquid interface. The current project will investigate
fundamental mechanisms which play an important role for the agglomeration of particles at the bubble surface. Another topic concerns the behaviour of particles in the vicinity of a propagating solidification front. The PhD candidate shall investigate the processes mentioned above by means of X-ray diagnostic techniques. The corresponding facilities and measuring techniques are available at HZDR.

Requirements:
- completed university education (master degree) in the fields materials science, physics or process engineering
- knowledge in the field of X-ray diagnostics and image processing, multiphase flows, solidification processes

Tasks:
- experimental investigation of the behaviour of gas bubbles passing a particle-laden liquid metal
- experimental investigation of the behaviour of particles at propagating solidification fronts
- Application of X-ray radioscopy for process visualization
- Application and further development of suitable algorithms for data analysis and subroutines for image processing
- Investigation of the influence of electromagnetically driven flows on the particle behaviour

For further information on all positions, please contact Dr. Sven Eckert, Tel.: +49 351 260 – 2132 (s.eckert@hzdr.de) or Dr. Gunter Gerbeth, Tel.: +49 351 260 – 3480 (g.gerbeth@hzdr.de).

In any case, please submit your complete application (cover letter, CV, certificates,...) by January 31, 2016 via Online application https://www.hzdr.de/jobs using the above given Vacancy Notice Numbers.

Scientist position
at MHD Department, Institute of Fluid Dynamics
of Helmholtz-Zentrum Dresden - Rossendorf (HZDR)

Yet without a vacancy notice number, the following scientist position will soon be officially announced.

The MHD department at HZDR is looking for a scientist (f/m) for the modeling of liquid metal based stationary electricity storage systems (liquid metal batteries).

Liquid metal batteries are a promising candidate for future large scale storage of electricity from volatile sources as photovoltaic and wind power. Single cells consist of a three layer arrangement of two liquid metals and a molten salt sandwiched in between them, forming stable density stratification. Not only is the MHD of such devices rich and interesting but also their integration into tomorrow’s power grids poses a number of challenges.

You should have a university degree (diploma or MSc) in the field of power engineering, electrical engineering, physics, mechanical engineering or process engineering. Interdisciplinary thinking, the ability for independent scientific work and active communication skills are essential for a successful implementation of the project. Experience in the modeling of battery storage systems and the knowledge of energy management systems would be advantageously. A background in fluid mechanics, heat- and mass transfer and/or electrochemistry would greatly facilitate the detailed simulation of liquid metal batteries.
Your tasks will include:

- the development of liquid metal battery models as building blocks in future energy systems based on volatile sources
- the requirement engineering and conception of the network integration (electricity and heat) of liquid metal batteries
- the participation in the definition of interfaces and the data base integration of the developed models
- the participation in the numerical simulation of liquid metal batteries

For further information, please contact Tom Weier (t.weier@hzdr.de) or Sven Eckert (s.eckert@hzdr.de).

The position will soon be announced on the HZDR web-page with a related vacancy notice number. Once this is case, please submit your complete application (cover letter, CV, certificates,…) before February 15, 2016 via Online application https://www.hzdr.de/jobs.