

## **WCE 2015 Plenary Keynote Speaker III:**

### **Speech Title: Modelling of automotive fuel droplet heating and evaporation: recent results and unsolved problems**

#### **Professor Sergei Sazhin**

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#### **About the Speaker:**

Professor Sergei Sazhin is a Professor of Thermal Physics based at the Sir Harry Ricardo Laboratories within the Centre for Automotive Engineering. He has spent the last 18 years researching and writing about the key issues in automotive engineering and has contributed over 410 research publications, including three monographs and 207 papers in international refereed journals, to the field.

Professor Sazhin gained his PhD degree (Physics and Mathematics) at St Petersburg State University (Russia) in 1977 before becoming a Fellow of the Institute of Physics and a Chartered Physicist. Following his time as a researcher at the Institute of Physics, St. Petersburg State University, Russia (1972-1982), Professor Sazhin worked as a Research Fellow in the Department of Physics, Sheffield University, UK between 1988 and 1992. This role was followed by four years in industry, working as a research scientist for Fluent Europe Ltd, Computational Fluid Dynamics Software and Consultancy Services in Sheffield, UK until 1996. Professor Sazhin joined the Centre for Automotive Engineering at the University of Brighton in 1996 as a senior lecturer.

Professor Sazhin's research work has been supported by 13 EPSRC grants (including four currently active grants), the European Regional Development Fund (Franco-British INTERREG IIIa, E3C3), the Royal Society and the British Council. Professor Sazhin is a member of the Editorial Board of the International Journal of Engineering Systems Modelling and Simulation and a member of the scientific committees of the French programme Methodes d'analyses experimentales et de simulations des brouillard multi-composant (2007-present), and Journal of Irrigation and Drainage Systems Engineering (2012-present). In addition, Professor Sazhin is instrumental in

organising international mathematical workshops on multi-scale asymptotics and hysteresis (2004-2014) and the World Congress on Engineering (2007-present).

Professor Sazhin's current research interests focus on:

- Mathematical modelling of fluid dynamics, heat transfer and combustion processes in internal combustion engines
- Modelling of heat and mass transfer processes in sprays
- Spray formation and droplet break-up

### **Abstract:**

Recent results of the investigation of biodiesel, Diesel and gasoline fuel droplet heating and evaporation are summarised. The results of calculations of heating and evaporation of biodiesel fuel droplets, taking into account the contributions of all components, using the discrete components models with finite and infinitely large species diffusivities, and assuming that biodiesel fuel can be treated as a one component fuel, are discussed. It is pointed out that there are serious problems with the application of the discrete components model, based on the analysis of diffusion of individual components, to the modelling of heating and evaporation of realistic Diesel and gasoline fuel droplets. Some results of the development of the generalised multi-dimensional quasi-discrete model and its application to realistic Diesel and gasoline fuel droplets are presented. New approaches, based on kinetic and molecular dynamics models, are briefly summarised, and the most important unsolved problems are identified.

Keywords: Automotive fuel, Droplet, Heating, Evaporation, Modelling, Multi-component.