

## SPARK

# Spark Plasma sintering Research In Nuclear Technology

### OBJECTIVES

Spark Plasma Sintering (SPS) is a beyond state-of-the-art fabrication technique that has become available for metal and ceramic powder processing. One the main foreseen nuclear applications of SPS is fuel pellet manufacturing, however several barrier exist to the implementation of SPS in nuclear fuel manufacturing particularly the manufacturing throughput of current techniques. A further barrier, is that SPS creates a carbon reacted layer in the near surface region of the fuel pellet as a result of contact with the graphite dies that are currently favoured.

Objectives of the SPRINT project are as follows:

- Investigate the ability of SPS to provide IMF Wasteforms with acceptable microstructures in order to increase their technological readiness
- Investigate formation of and methods of removal for graphite interaction layers between sintering materials and powders
- Conduct literature review to assess deployability of the SPS technique for nuclear applications; i.e. ATF, reactor components, waste forms, etc.
- Increase awareness of the technology with the public and nuclear community and seek opportunities for collaboration with similar projects
- Assess potential of the technology and identify key areas for follow up, including the potential for larger projects and collaborations

### DESCRIPTION OF WORK

SPARK will investigate some of the barriers to the adoption of SPS, particularly in the area of fuel manufacturing, and provide solutions to pave the path for its deployment as a safe and economic processing method. A review will also be carried out to assess applications in the manufacture of reactor components for current and innovative Light Water Reactor (LWR) designs and in the production of waste forms. The project will also provide a training opportunity for researchers interested in this topic area and ensure wider dissemination through hosting of a SymPoSium.

The project is divided into six work packages as follows. Each of the work packages (WPs) will be led by a partner with the necessary expertise and ability in the relevant field.

- o WP0 – Project Management (NNL)
- o WP1 – UO<sub>2</sub> Fuels (JRC-ITU)
- o WP2 – MOX Fuels (NNL)
- o WP3 – Accident Tolerant Inert Matrix Fuel “IMF” Waste forms (KTH)
- o WP4 – Wider Nuclear Applications of SPS (NNL)
- o WP5 – Education, Training and Dissemination (KTH)

### MAIN RESULTS / HIGHLIGHTS

Position paper on preparation of (U,Zr)N via the SPS technique

### PARTNERS

NNL / JRC-ITU / KTH

### CONTACT

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### DURATION

1 April 2015 – 30 September 2016

18 months