Iridium-based intermetallics have high melting points, high hardness, good erosion and oxidation resistance. Compared with UHT ceramics iridium intermetallics have crack resistance and high thermal conductivity. These features are necessary for design of UHT materials. Among iridium-based intermetallics, the hafnium-iridium system is the most attractive one in terms of the oxidation resistance. Indeed, hafnium dioxide has the lowest vapor pressure at high temperatures among refractory oxides. Iridium has very high melting point, non-reactive with carbon below the eutectic temperature and has very low solubility in carbon. Oxidation mass loss rates for iridium are extremely low, therefore, it can be served as an effective diffusion barrier for inward oxygen.

The aim of this work was to study the possibility of HfIr$_3$ formation via direct reaction of hafnium carbide and iridium. Hafnium carbide and iridium powders were mixed in different ratios and heated in the 1000 - 1600°C temperature range. The products were analyzed by different analytical techniques including SEM/EDS, quantitative XRD analysis, Raman spectroscopy. The results showed that solid-state reaction between HfC and iridium starts at temperature as low as 1000°C and proceeds with the formation of HfIr$_3$ - based solid solutions. The lattice parameter of HfC was not changed, therefore, it was concluded that there are no any Hf-C-Ir solid solutions. Disordered carbon phase as sheets was detected in products.

The HfIr$_3$-based materials were tested using arc-jet. The behavior of materials at high temperatures is discussed.