ENVIRONMENTAL CONICAL NOZZLE LEVITATOR EQUIPPED WITH DUAL LASERS

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A levitation device equipped with environmental controls and oxygen mitigation has been used to analyze molten samples using laser heating. To date, the highest temperature achieved in this system is ~4000 ˚C; achieved using a molten HfO_2 sample. This device is equipped with two lasers to enable heating and melting of a variety of high temperature materials: a 400 W CO_2 laser (10.6 µm wavelength) and a 500 W Ytterbium Fiber laser (1.07 µm wavelength). The temperature is determined using two single-color laser pyrometers at 0.9 µm (750 – 3500 °C) and 0.65 µm (750 – 5000 °C). To avoid reaction, poisoning, and oxidation, this system uses a sealed environmental chamber that is vacuumed to <500 Pa ($<5 \times 10^{-3}$atm) and filled with ultra-high pure Argon (<1000 ppb reactive gases) which is then passed through a reactive getter to <1ppb reactive gases. Oxide samples are levitated in oxygenated streams. This system was used to determine the melting point of 3 mm diameter spherical samples of various metal (Ni, Nb, Ta, Ti, W), oxide (Al_2O_3, HfO_2, Ta_2O_5, ZrO_2, TiO_2, Nb_2O_5), and diboride (TiB_2, NbB_2, ZrB_2, HfB_2, TaB_2) samples. The melting point was determined by analyzing the cooling curve created from heating the samples above the melting point and observing the recalescence as the sample solidifies. Corrections were made for sample emissivity to ensure temperature accuracy.