Design and development of a vacuum crystallization chamber for fluoride materials synthesis and direct solidification using cost-effective RF heaters

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Abstract:

The usage of fluoride materials has been applied for more than a century, which includes wide-ranging research areas such as laser, Scintillator, mid-IR and magneto-optical applications. These fluorides are having very interesting features such as a wide transparent spectral range from VUV (vacuum ultraviolet) to the IR (Infra-Red) region and a low refractive index. Although metal fluorides are having several good features, the major problem with these compounds is the experimental part. The aggressive behavior of fluoride melts and vapors sets forth specific requirements for construction materials, such as heaters, crucibles, thermo-insulators, and other materials used in crystal growth devices. Herein we designed and developed a homemade chamber for fluoride materials synthesis. Mainly, this chamber works with an economically cost-effective Radio Frequency (RF) heater, which is easily available in commercials. The photograph of the developed furnace is shown in the Figure. This chamber consists of several features for the synthesis of fluoride syntheses such as an anti-corrosive metal body, CF_4 and Ar gas provision, high vacuum facility, and CF_2 window facility to monitor. The power consumption and temperature stability over time will be discussed in more detail.

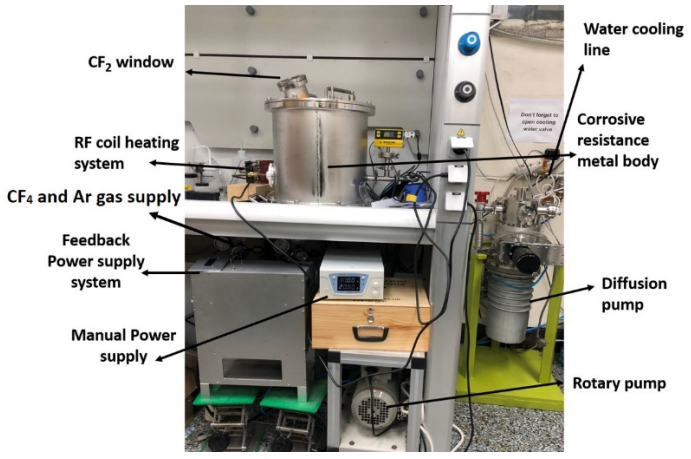

Figure 1. Photograph of the developed vacuum crystallization chamber