

Spark Plasma Sintering Technique for Cyclotron Solid Target Manufacturing for Nuclear Medicine

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In recent years, Spark Plasma Sintering (SPS) has become a valuable technique in many industrial and scientific areas. It has also found application in the medical field, particularly in radionuclide production. INFN-LNL (National Institute for Nuclear Physics - National Laboratories of Legnaro) was the first group to demonstrate the promising results of using the SPS technique to produce solid targets, which are a crucial part of the medical radionuclide production chain. Manufacturing solid targets is a complex process that relies on different areas of knowledge and has its unique requirements. The starting material for the target is usually an expensive isotopically enriched powder, which requires attention to the material losses and method efficiency. Moreover, to withstand prolonged irradiation with high-intensity cyclotron beams and transportation to the hot cell, targets must possess certain mechanical characteristics. Additionally, the SPS was used for binding different materials, enabling the assembly of complex target designs.

This work will provide an overview of the solid targets design and production process using the TT_Sinter machine, designed and created for this application by the University of Pavia. Targets manufactured using SPS have been used to produce several promising radionuclides: $^{52/51}\text{Mn}$, ^{89}Zr , $^{61/64/67}\text{Cu}$, and ^{155}Tb . A reliable production chain for radionuclides enables more radiopharmaceuticals to be studied and made available to patients.

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