DOUBLE-GRID [^{18}O] WATER TARGET FOR KIRMAS-13*

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Abstract

[^{18}O] water target with double grid system has been developed for KIMRAS-13. Water cooled grid system was adapted to reduce maintenance and simplify the whole target system. Target body is made of titanium. Volume shape of target is not uniform along volume depth. Cross section of the rear has a fan-shape and the front side has circular-shape. Wider cross section at rear increases the heat transfer performance. Both sides of cavity for target volume were blocked with 0.05 ㎜ titanium foils. Aluminium grids were set on the both foil to prevent expansion of the foils. The front grid is water cooled grid and the rear gird is exposed to water impinging jet to cool foils. Circular grid holes were arrayed in a hexagonal pattern. Water cooled grid with 84% open area has been tasted.

INTRUDUCTION

Fluorine-18 is widely used radio-isotope in positron emission tomography. Enriched [^{18}O]water target have been constructed for [^{18}F]fluoride production for many years. Material of the target, shape of cavity for [^{18}O] and cooling mechanism have been changed as the research has performed. All different structures of targets were developed to get better performance for good yield and long running time without maintenance at high energy. Materials were chosen to overcome [^{18}F] impurity, Shape of the cavity has been changed to overcome the phase change problem and cooling methods are getting smarter to make the target work in more high energy circumstance[1-5]. Water-cooled grid support system has better structural strength than double-foil system[6]. We have developed the double-grid [^{18}O]water titanium target. Better cooling performance and high [^{18}F] yield were expected.

STRUCTURE OF THE TARGET

Fig. 1 shows the main parts of double-grid target. Material of cavity and foils are titanium. The shape of cavity has two different geometries along beam incident direction. The front volume has a cylinder shape and the back cavity has a fan shape with larger volume to gather ascent vapour bubbles and increase heat transfer area. Total volume of cavity is 1.6 ml. Both open sides of cavity are blocked with 50 μm titanium foils. Two aluminium grids are placed out side of each foil. Grids were adapted basically to cool foils and prevent their thermal expansion under high pressure. Front water cooled type gird is directly place in the vacuum beam line. This grid has water channel to be cooled. The front Ti foil cooling performed by the front grid by only conduction. Rear part cooling mechanism consists of water impinging jet cooling. The functions of rear gird for cooling are increase the turbulence of impinging water jet and increase the cooling surface. Pictures and assembly of the target are presented in fig. 2. Cooling method for target is also described. Foils are welded on the both sides of cavity and between other pats viton O-rings were inserted.

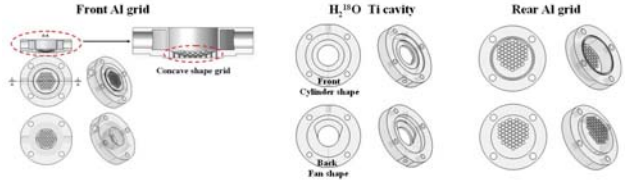

Figure 1. Al double-grid and Ti cavity structures

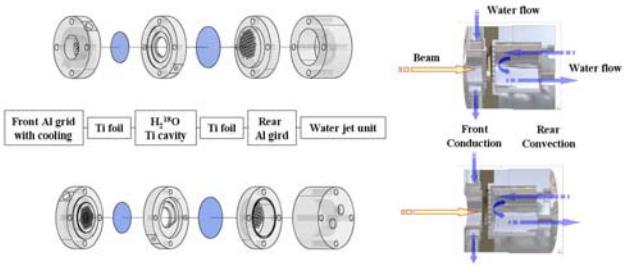

Figure 2. Assembly of the target

TARGET TEST AND RESULT

13MeV proton had bombard to target with beam current 10 μA, 20 μA, 30μA and 40 μA for 1 hour. [^{18}F] yield and pressure were measured. Yield and pressure increase almost linearly as the beam current increases. Corresponded pressure data to beam current is significantly lower than any other water target(Fig. 3). This result represent that the cooling performance of double grid system is excellent. Yield data are shown at fig. 3.

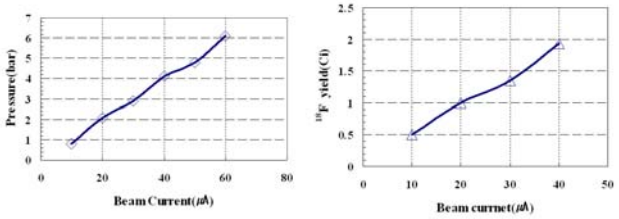

Figure 3. Pressure and yield data

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