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DESIGN OF A VACUUM CHAMBER FOR FILM DEPOSITION BY MAGNETRON SPUTTERING

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1. Introduction

Magnetron sputtering is a traditional thin film deposition method, suitable for processing of wide range of materials and scalable for industrial applications [1]. In this technique, a high vacuum level for optimal and contamination-free processing is mandatory, requiring a vacuum chamber composed of materials with chemical stability and mechanical resistance. Among the options available, stainless steel is the most used due to its inert surface and resistance to high-pressure gradients [2]. Thus, this work presents details of a vacuum chamber made in stainless steel for film deposition by magnetron sputtering, focusing on design and material selections.

2. Experimental

The cylindrical chamber, with 400 mm diameter and height, 4.25 (side) and 10.00 mm (top and base) wall thicknesses, was designed in *SolidWorks* and evaluated wall deformation under 1 atm pressure gradient. The position of the flange for the vacuum system and other features such as flow and energy of the sputtered particles, as a function of the target-to-substrate distance, were evaluated through SIMTRA software [3].

3. Results and Discussions

Fig. 1 shows that the highest deformation, lower than the yield limit, was observed in the center of the top plate where the magnetron will be installed, indicating the mechanical stability of the chamber. Fig. 2 shows the number of particles reaching the substrate holder (12 cm diameter) as a function of the target-to-substrate distance, with the flange of the pumping system positioned at different places, being two positions at the base plate (blue, centered flange; red, off-center flange) and one position at the side wall (orange). The particle flow toward the centered flange decreases as the target-to-substrate increases, decreasing losses for the pumping system.

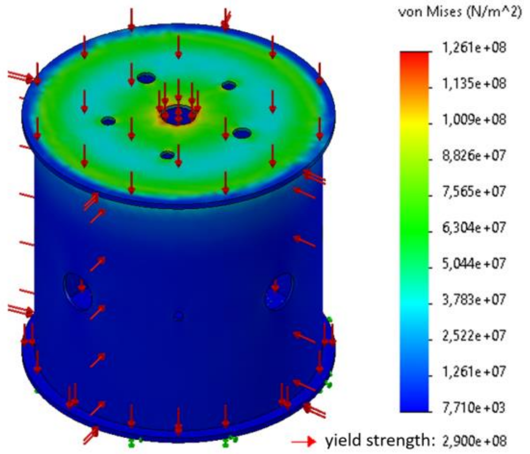

Fig. 1. *Simulation for chamber wall deformation due to a 1 atm pressure difference.*

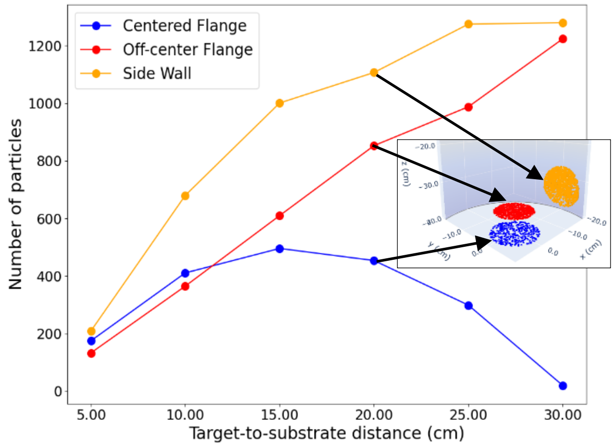

Fig. 2. *Number of particles reaching key places as a function of the target-to-substrate distance.*

4. References

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