

The Non Evaporable Getters with High Throughput Pores and Chalking Resistance Applied to the Hydrogen Maser

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The getter pump composed of various non-evaporable getters (NEG) plays an important role by their ever-increasing applications in vacuum technology¹. In this work, the Ti-V-Fe-Cr spherical powder produced by plasma rotating electrode method for getters manufacturing. The Ti-V-Fe-Cr getters with spherical powder were prepared by a traditional powder metallurgy process.

The results were shown that phase structure of $\text{Ti}_{56.97}\text{V}_{35.85}\text{Fe}_{7.18-x}\text{Cr}_x$ getters consist of α -Ti and C15- TiV_2 phase. With the increase of Cr content, the hydrogen absorption kinetics of the alloy increased from 90 s to 25 s; the hydrogen absorption capacity increased from 2.19 wt% to 2.24 wt%; and the plateau pressure at room temperature decreased from 10^{-10} Pa to 10^{-13} Pa. When $x = 7.18$, the getters obtained the best hydrogen absorption performance. Which is that the addition of Cr reduces the diffusion activation energy of hydrogen in the getters. The $\text{Ti}_{56.97}\text{V}_{35.85}\text{Cr}_{7.18}$ getter was not pulverized after hydrogen absorption, and the hardness of the getter increased from 345.3 HV to 379.9 HV. The practice of energy level transition signals on hydrogen masers shows that the gas generated during the activation process of $\text{Ti}_{56.97}\text{V}_{35.85}\text{Cr}_{7.18}$ getters do not pollute the storage bubble and energy level transition signals of the hydrogen maser, so it does not affect the energy level transition signals of the hydrogen maser. When the $\text{Ti}_{56.97}\text{V}_{35.85}\text{Cr}_{7.18}$ getters were tested in the hydrogen maser, its energy level transition signals center frequency was 1420.407302 MHz and the amplitude was 2.04 dB and the activation temperature is 450°C.

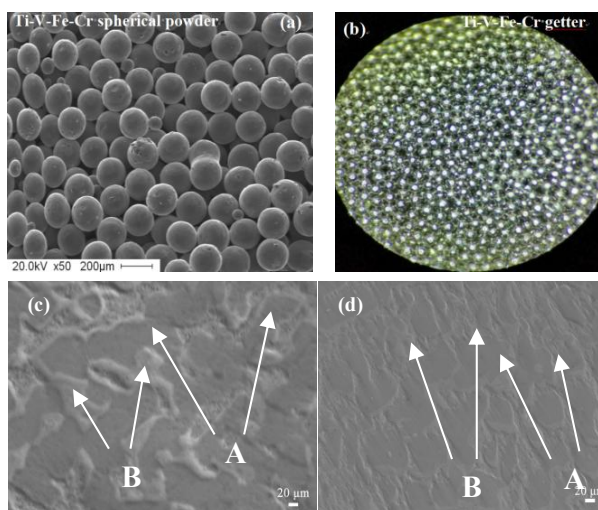


Fig. 1:Ti-V-Fe-Cr spherical powder (a) and getters (b), SEM of $\text{Ti}_{56.97}\text{V}_{35.85}\text{Fe}_{7.18-x}\text{Cr}_x$ (c, $x=0$;d, $x=3.59$) The black area A is composed of a small amount of Ti element, V element, Fe element, and Cr element, which is the primary TiV_2 phase. The white area B is composed of Ti elements with a small amount of V element, indicating that the layered structure is an structure of α -Ti and TiV_2 phase.

¹ Benvenuti C, Chiggiato P, Cicoira F, et al. Decreasing surface outgassing by thin film getter coatings. Vacuum 1998; 50(1-2): 57-63