A New Polysiloxane/Ceramic Composite for Space and Nuclear Fusion Applications

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In 2005, SpaceX first referred to a concept with some of the Starship's capabilities. In 2016, Elon Musk announced the Starship is going to be made out of carbon based composite material. In late 2019, Musk officially talked about the Starship material's transition from carbon composites to stainless steel, claiming lower cost, higher melting point, Ultra-Low temperature resistance, and ease of manufacture. SpaceX used stainless steel to solve this problem but stainless steel is five times heavier than carbon fiber. In the space industry reducing weight is one of the main aims. In the past Joint European Tourus had carbon heat tiles, but now it uses Beryllium-Tungsten based heat tiles. back in the carbon days JET was so much easier to operate but nowadays it is much harder. Also Tritium has the tendency to bond with carbon to form hydrocarbons which was a trait of the carbon. Aim of this research is developing a composite material that is cheaper, lighter, easier to manufacture and can withstand extreme temperatures and temperature differences and high vacuum also needs to be unreactive to the Tritium. In the scope of this research project various preceramic/ceramic composites are manufactured. Then heated in a muffle furnace for converting preceramic to ceramic. These materials tested for thermal properties. The Vacuum compatibility of the samples were tested using a mini scale and vacuum chamber. The ion reactivity of the samples is simulated using a software called SRIM. In Conclusion, the new ceramics are vacuum compatible and could be used for space applications. The composite is easily produced and formed into the shape. The SRIM simulations showed that %50SiC have batter stopping properties for tritium and deuterium than other samples.

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