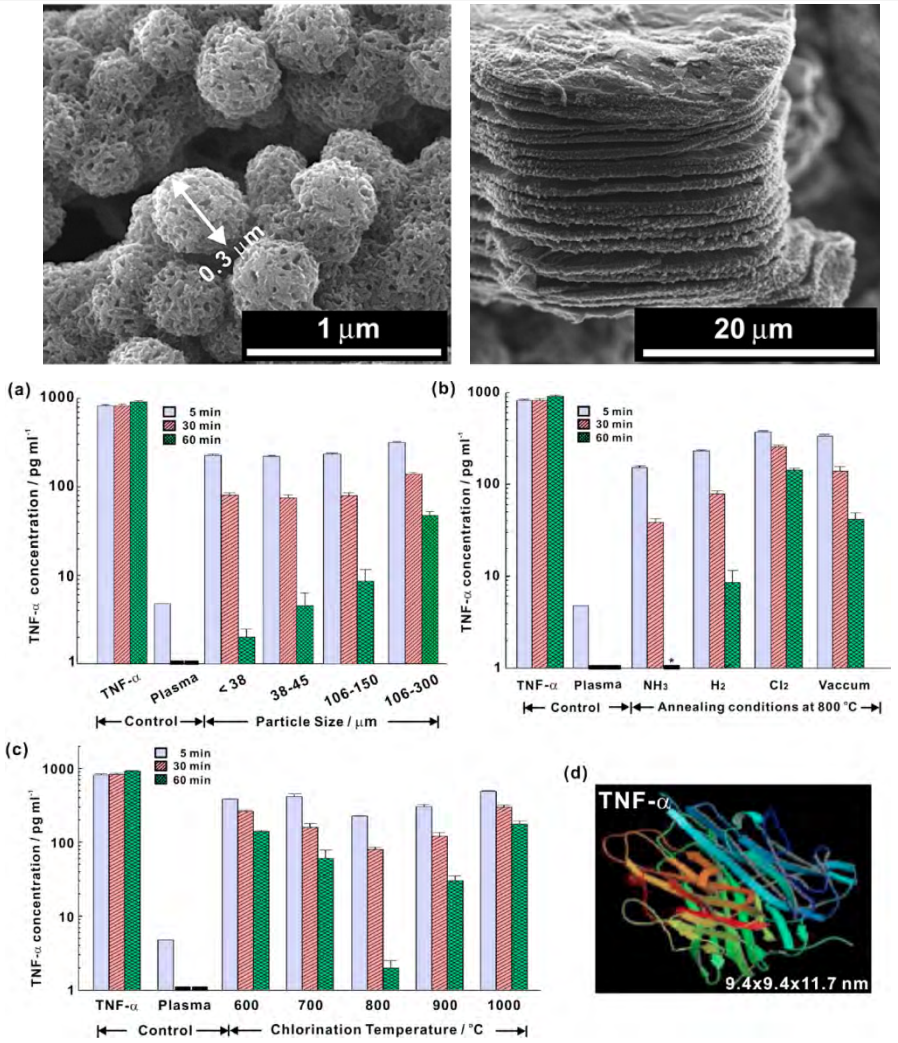
Carbide Derived Carbons with Pore Structure and Surface Chemistry Designed for Selective Adsorption of Proteins

PI: Yury Gogotsi (Drexel University), DMR--0945230

This program is aimed at development of Carbide Derived Carbon (CDC) - based system for selective and efficient removal of cytokines from blood circulation and better understanding of the mechanisms of protein adsorption in mesoporous carbon materials. High levels of cytokines released by a human body is the main cause of mortality associated with sepsis, with mortality rate of 40-80%. We investigated adsorption of cytokines by CDC with tunable pore size, surface area, and surface chemistry; and identified the CDC material with optimal properties to remove >99% of cytokines from blood plasma within the first 60 min. A study of protein adsorption in a model system – carbon-coated alumina membranes with controlled pore diameter and surface chemistry – has been undertaken in order to gain better insights into the mechanisms of the adsorption of proteins in carbon pores.



SEM images of Ti_2AlC-CDC and plots of CDC adsorption of the cytokine TNF-α from human plasma as a function of (a) CDC particle size, (b) annealing gas, (c) chlorination temperature; (d) a model of TNF-α.

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