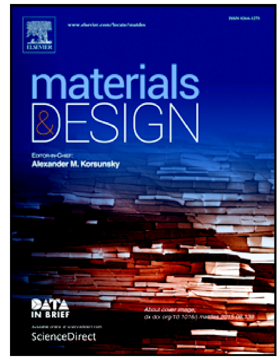


# Dispersed and size-selected WO3 nanoparticles in carbon aerogel for supercapacitor applications

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# Dispersed and size-selected $WO_3$ nanoparticles in carbon aerogel for supercapacitor applications

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**Abstract:** In this study, the dispersed and size-selected $WO_3$ nanoparticles have been successfully incorporated into carbon aerogel (CA), a conductive, mesoporous hosting template, via solvent-immersion process and subsequent calcination treatment. Size selecting of $WO_3$ in CA is achieved via a facile route of concentration adjustment of immersion solution. Meanwhile, the strong dependence of capacitive performance on size distribution and dispersing/aggregate condition of $WO_3$ nanoparticles in CA is observed. Also the dependence of the specific capacitance of $WO_3$ in CA on $WO_3$ content and on its mean size is presented by comparison with the reported studies. Consequently, the mean size of $WO_3$ nanoparticles in CA is reduced to 7.3 nm and the range of size distribution of those is confined to 1-25 nm with well-dispersing features by applying optimal processing parameters. Such optimized $WO_3$ nanoparticles in CA exhibit a maximum specific capacitance of 1055 F $g^{-1}$ at 5 mV $s^{-1}$, which is much higher than as-reported capacitance values achieved with $WO_3$ as the electrodes up to now for all we know. This study offers a new method to achieve high capacitance by compositing size-selected metal oxide nanoparticles with cheap high-conductivity mesoporous template.
**Keywords:** Supercapacitor; Tungsten oxide; Carbon aerogel; Nanoparticle; Electrochemical performance.

## 1 Introduction

Nowadays, the energy storage devices generally include conventional dielectric capacitors, batteries, fuel cells and supercapacitors (SCs) [1]. Among energy storage devices, SCs, also named electrochemical capacitors, have drawn wide attention, because of their long-list advantages [2-5]. According to the charge storage mechanism, SCs could be classified into two types, namely electrical double-layer capacitor (EDLC) and pseudocapacitor [6]. In contrast to EDLCs, pseudocapacitors commonly including various transition metal oxides such as $RuO_2$, $MnO_2$, NiO, $TiO_2$ and $WO_3$ or conducting polymers like polypyrrole (PPy) and polyaniline (PANI), possess the capacity of higher energy storage [7-16].

Low electrical conductivity and specific surface area are widespread shortcomings

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