# High-Performance $V_2O_5$ Based Flexible Symmetric Solid-State Supercapacitors

Pei-Tzu Li[1](李佩慈), Yo-Cheng Che[2](車祐成), Tzung-Han Chou[1](周宗翰) and Ming-Jay Deng[3]* (鄧名傑)

[1] Department of Chemical and Materials Engineering, National Yunlin University of Science and Technology, Yunlin, Taiwan

[2]Department of Engineering and System Science, National Tsing Hua University, Hsinchu, Taiwan

[3]Bachelor Program in Interdisciplinary Studies, National Yunlin University of Science and Technology, Yunlin 64002, Taiwan

E-mail:dengmj@yuntech.edu.tw

MOST 107-2218-E-224-002 -MY2

## Abstract

General vanadium oxide supercapacitors (SCs), have limited specific capacitance, electrochemical stability and are out of tune with wearable devices. To overcome all these limitations, a network $V_2O_5$ nanofibers was manufactured on a novel conductive printing paper (U-Paper) as electrodes linked with Urea-$LiClO_4$-PVA (ULP) neutral solid-state electrolyte for network $V_2O_5$ wearable symmetric supercapacitors (WSSCs). The function of ULP electrolyte not only can be doped into the conductive ink to decrease the resistance of conductive printing paper but also increases the stability of $V_2O_5$–based electrode. Moreover, network $V_2O_5$ WSSCs with ULP electrolyte are capable to support for a high operating voltage of 4.0 V, and offer high energy density (355 Wh/kg at 0.2 kW/kg). The $V_2O_5$ WSSCs show superior cycle stability/durability after 5000 cycling (capacitance retention of ~91%). The $V_2O_5$ WSSCs with ULP electrolyte demonstrate great potential as the prospective candidate for smarter 3D wearable energy storage devices and Internet of Things applications.

Keywords : flexible supercapacitor, ionic liquid, solid state electrolyte, wearable, $V_2O_5$