

Electronic Supplementary Information (ESI)

## **Formation of new electric double percolation via carbon black induced co-continuous like morphology**

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### **Experimental methods**

#### **1. Materials**

PLA (4032D) was purchased from NatureWorks Co. Ltd., USA. PU (WHT-1570) was purchased from Yantai Wanhua Polyurethanes Co. Ltd., China. CB with a primary particle diameter of 30 nm (Printex-XE2B) was purchased from Degussa Co. Ltd, Germany.

#### **2. Sample preparation**

At first, PLA, PU and CB were dried under vacuum overnight at 60 °C. Then, PLA/PU/CB ternary composites were prepared by melt blending various amounts of CB (0~10 phr) with PLLA/PU blend matrix (85:15 w/w) in a internal mixer (XSS-300, Qingfeng Mold Factory, Shanghai, China) at 190°C and 60 rpm for 5 min. At last, the obtained mixtures were compression molding at 190°C for 5 min under 10MPa to gain the standard specimens for mechanical and electrical testing.

#### **3. Characterization**

The morphological structures of PLA/15PU blend with various amounts of CB were observed by an FEI Inspect F scanning electron microscope (SEM, USA) at an accelerating voltage of 5.0 kV. The specimens for the SEM observation were cryogenically fractured in liquid nitrogen. The phase morphology was inspected by TEM (JEM-2010) at an accelerating voltage of 200 KV. The ultrathin-sections with thickness of 100 nm were cut by using a Leica UCT microtome. The notched Izod impact toughness was evaluated using an impact tester (XJU-5.5, China) at 23°C. Tensile properties were measured using a tensile testing machine (SANSI, ShenZhen, China) with a crosshead speed of 5 mm/min at 23°C. The electrical conductivity was measured using a Keithley 6487 picoammeter at a constant voltage of 1 V with two points method. Silver paint was applied onto both ends of the sample to eliminate the effects of contact resistance. At least five specimens of each group of sample were measured to obtain an average value.

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