# The Effect of Copper-Aluminum Bimetallic Metal Organic Framework Based Electrode on the Energy Stored in a Supercapacitor

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As the world seeks safe, sustainable sources of energy storage, supercapacitors are becoming a lucrative option, with their rapid charging capabilities and long lifespans. Their adoption can be facilitated by increasing their energy storage capabilities with porous electrode materials such as Metal Organic Frameworks (MOFs). To enhance catalytic and electronic properties, secondary metal ions are introduced in the construction of Bimetallic MOFs (BMOFs). This research aimed to synthesize a novel BMOF using Cu and Al, study its properties through SEM and XRD, and use the synthesized BMOF in the construction of activated-carbon (AC) based hybrid supercapacitors. Various quantities of Cu-Al BMOF (0.5 g, 1g, 1.5 g) were used with AC to form the cathode in the experimental groups while the control group contained only AC based cathodes. The research was conducted by subjecting supercapacitors to 10 second charge cycles and measuring the voltage change during intervals within 2 minute discharge cycles. Capacitance was derived from these voltage values and was used to determine the energy stored. Compared with the control group, the 1.5g BMOF stored 144% more energy, the 1g BMOF group stored 88% more energy and the 0.5g BMOF group stored 33% more energy. My hypothesis was supported as the 1.5g group exhibited the greatest energy storage. The new Cu-Al BMOF increased energy storage through increased porosity, surface area, and conductivity in the electrode. Further improvements include purification of the BMOF to improve storage. Further research includes functionalizing Cu-Al BMOF to enhance conductivity.

**Awards Won:**

Second Award of $2,000