



Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Natural Eutectogels as a Novel Material for Green Electronic Skin

Finalist's Name: Sophia Zhang

School and City: Fairview High School, Boulder

Sponsor's Name: Prof. Rong Long

Category: Chemistry

Division: Senior (grades 9 - 12)

Abstract (250 words or less):

The rapidly growing field of wearable electronics faces a critical challenge: the development of interface materials that are conductive, soft, and compatible with human skin to effectively monitor body activity. Traditional materials such as hydrogels and ionogels face several challenges including dehydration in open air, poor temperature stability, rigidity, and discomfort.

My project introduces a transformative solution: a eutectogel-based electronic skin that is sustainable and easily synthesized. Eutectogels are an innovative material formed by the polymerization of a deep eutectic solvent (DES) consisting of hydrogen bond donors (HBD) and acceptors (HBA) mostly derived from naturally occurring compounds. Following my research last year in improving the mechanical properties of the gel through the addition of cellulose fibers, I identified a lack of conductivity and the need to validate biocompatibility as major areas for improvement.

My unique contribution is the development of a highly conductive eutectogel composite through the addition of PEDOT:PSS. This addition enhances the electrical properties of the gel while maintaining excellent elasticity and deformation recovery. Through extensive screening, I identified an optimal composition and preparation process for a eutectogel consisting of DES components and PEDOT:PSS to achieve a >100 times improvement in conductivity and >2.5 times increase in elongation at break. Biocompatibility testing validated the low cytotoxicity of the material. These enhancements enable this e-skin material to effectively capture and transmit biopotential signals (e.g. brain signals) for long-term and reliable health monitoring.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature:

Date:

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. **A signed copy of this form must be included in your notebook.**