CO_2 Glue: Green Epoxy-like Adhesives

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U.S. DEPARTMENT OF ENERGY | National Energy Technology Laboratory

The Summary

This adhesive is a "green," environmentally friendly epoxy that utilizes inexpensive CO_2 as a starting material, consists of composites that can be cured either thermally or with light, and has a scalable, high yield manufacturing process.

The Problem

Problems with existing epoxies:

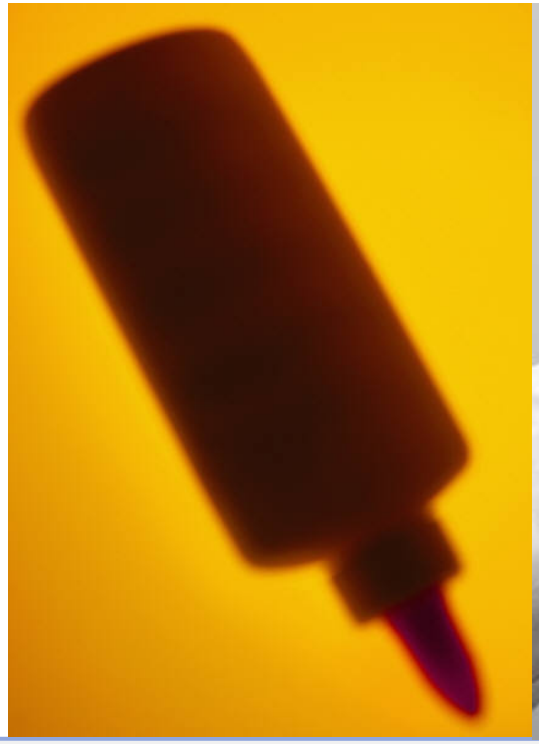
- They create volatile emissions that are toxic
- They require poisonous chemistries
- They require environmentally nasty chemistries
- They typically require a specific type of curing (toughening/ hardening in material creation process): either heat or light
- They tend to be made from petrochemicals

The Solution: An Environmentally Friendly Superglue

- **Excellent adhesive properties**
  - Exceptionally well with glass and metal
- **Environmentally friendly**
  - No isocyanates
  - Solvent free
  - Uses CO_2 as one of its components
- **Simple chemistry, using a mix and cure method to create**
- **UV or thermal curing**
- **Can be transparent or light yellow in color**
- **Mixes well with silica gel**
  - Flow properties can be modified easily
- **Made from the off the shelf, commercially available components**
- **An environmentally friendly super glue**
- **Should cost less to make**

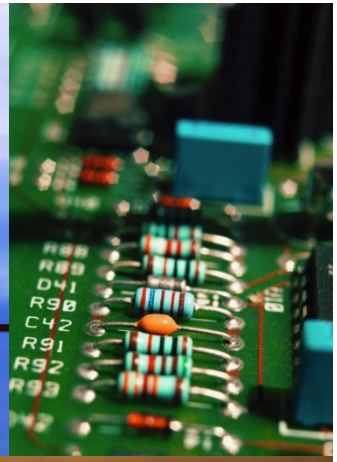
The Opportunity

- **The global adhesives market estimated to be worth $21,527.0 million in 2010 and is expected to reach $28,659 million by 2016[1]**
- **The specialty adhesives market is valued at $2.4 billion.**



1. *Global Adhesives and Sealants Market by Type, Applications, Trends, and Forecasts (2011-2016)*
2. *http://www.freedoniagroup.com/Specialty-Adhesives.html*

The Opportunity



The adhesive has potential for use in the following markets:

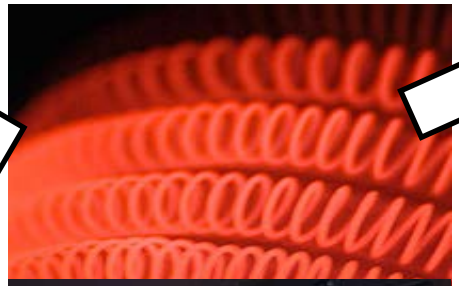
- **Transportation: Marine, Aerospace, Automotive**
  - **Glass and metal joints**
  - **New composites for automotives, aircraft, boats, and housing requires better adhesive/binder properties (decreases weight)**
- **Automotive manufacturers**
- **Recreational sporting good producers**
- **Electronics – anything with a printed circuit board**
- **Military**
- **Building materials**

The Process

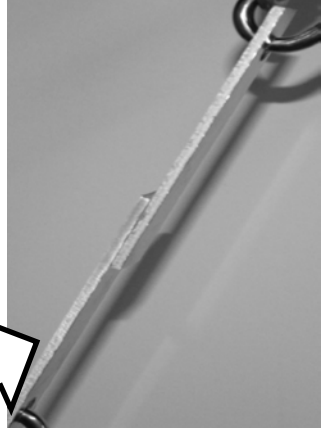
CO_2-based Precursor

Simple Mixing

Thermal Curing

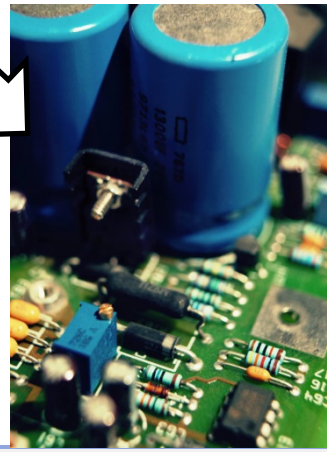


UV Curing



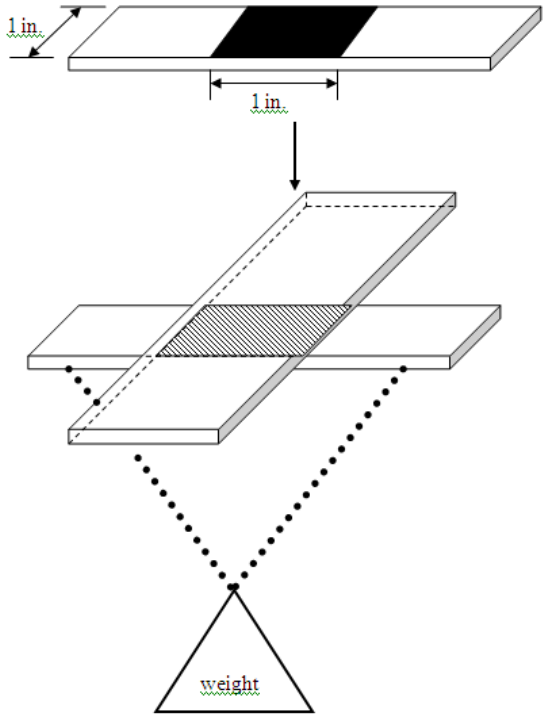
Glass Adhesive
Metal Adhesive
Fiber Binder

Electronics Composites



Successful Adhesion Testing Perfomed

- Used aluminum plates
- Applied 1 square inch of adhesive (7-8 mg)
- Fully suspended the plates with 125 lbs



Partnership Opportunity

This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

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