

# Solventless Process for Making Tackifiers and Adhesives (ANL-IN-05-035)

Environmentally friendly and economical, Argonne's new process will benefit a variety of industries.

## The Opportunity

Worldwide, over 2.5 million tons of pressure-sensitive adhesives (PSAs) are manufactured annually and used in the pulp and paper, electronics, wireless telecommunications, medical devices, cosmetic and personal hygiene, and other industries. Conventional PSAs are made by combining a tackifier dispersion with a latex emulsion. Some tackifier dispersions are made by using resins that melt at less than 100°C, while others use resins that melt at high temperatures.

One problem is that both the low-temperature-melting resins and high-temperature-melting resins used for making tackifiers are not miscible in water. Therefore, the resins must be "liquefied" by dissolving them in a solvent (as is the case for the high temperature-melting types) or by heating them to above their melting point (as is the case for the low-temperature-melting types) and then slowly adding them to water as they undergo agitation over several hours. This conventional process is batch- and energy intensive, requires the use of excess water, and takes several hours to complete.



*Commercially Used High-Temperature Melting Resin Flakes before Pulverizing (right) and Powdered Resin after Pulverizing (left)*

## The Solution

Argonne has developed an energy-efficient, environmentally friendly, and economical solvent-free process for making tackifier dispersions (substances used to make glue for stamps, stickers, and other common adhesive products) for manufacturing pressure-sensitive and other types of adhesives.

Unlike conventional processes, Argonne's process operates at ambient temperature and ambient pressure and does not use organic solvents — parameters that affect processing time, energy consumption, cost, and the environment. The new process reduces the cost of manufacturing the tackifier dispersion by over 35%, requires less than 25% of the energy sources consumed by the current standard process (thereby cutting the emissions of greenhouse gases), and reduces the amount of water consumed in the manufacture of tackifiers.

### Process Outperforms Conventional Technology:

By reducing the resin to an average particle size of less than 5 micrometers, the tiny particles can be dispersed in water in minutes — eliminating the need to melt them by using heat or dissolve them in solvents. The process also eliminates the need for using and transporting excess water. Compared with existing, conventional water-based processes for making tackifiers, Argonne's process results in energy savings of over 75%. This novel process is also quick. It requires only a few minutes — versus several hours for the conventional process — to form a dispersion.

## Diverse Applications, Commercial Interests:

Manufacturers involved in the dispersion of solids in liquids to form emulsions or dispersions can use Argonne's process. In addition to the tackifier and adhesives industry, the food processing industry, the pigments industry, and others will benefit from this new technology. For example, the pigment industry will benefit from this process because the fine particles will be more uniformly distributed, resulting in more uniform color and a higher product quality. It can also be used to enhance the rate of reactions that take place at solid interfaces because of the large surface area per unit mass of the pulverized particles.

## Benefits

- ▶ Energy-efficient because Process reduces primary energy consumption by over 75%, compared with conventional Process
- ▶ Environmentally friendly because it eliminates the need to use hazardous organic solvents
- ▶ Likely to result in new tackifier products made with a mixture of resins having different melting points and different solubility properties
- ▶ Cost-effective because it allows adhesives to be made in a single step
- ▶ Adaptable because process can be used with commercially available equipment, yielding further cost savings
- ▶ Could open new markets for manufacturers of tackifiers or resins because dry, pulverized resins can be shipped instead of emulsions
- ▶ Faster than conventional processes

## Applications

- ▶ Glue for stamps and stickers
- ▶ Adhesives for the pulp and paper industry
- ▶ Adhesives for the electronics and wireless telecommunications industries
- ▶ Adhesives for medical devices
- ▶ Adhesives for cosmetic and personal hygiene products
- ▶ Pigment industry
- ▶ Food processing industry

## Contact

Argonne Technology Development  
and Commercialization  
partners@anl.gov  
800-627-2596

