

# **Polyvinyl alcohol (PVA) Processing with PPS and BR**

## **Standard Operating Procedure**

**Faculty Supervisor: Prof. Robert White, Mechanical Engineering (x72210)**

**Safety Office: Peter Nowak x73246 (Just dial this directly on any campus phone.)  
(617)627-3246 (From off-campus or from a cell phone)**

**Tufts Emergency Medical Services are at x66911.**

For more information on PVA, PPS, and BR processing see:

Zhang, L., *et al.* High-Performance Photovoltaic Behavior of Oriented Purple Membrane Polymer Composite films. *Biophysical Journal* 84(4) 2502-7.

Revised: April 15, 2008

---

### **1. Material Requirements:**

**1.1 Equipment:** Any approved container in cleanroom.

*Note: Any chemical containers including PMP, PC, PP, PS, PVDF, PTFE and any non-water soluble polymer is permitted. Other containers should be approved through the faculty supervisor prior to use.*

**1.2 Chemicals:** Polyvinyl alcohol (PVA), Bacteriorhodopsin (purified protein from *Halobacterium salinarum*), 3-(1-pyridinio) propane sulfonate (PPS)

**1.2.1 Hazards associated with chemicals:**

**1.2.1.1** At the concentrations to be used there are few hazards associated with PPS and BR. They may cause irritation in eyes and on skin, so use appropriate PPE.

**1.2.1.2** PVA may cause eye and skin irritation and is not usually flammable.

**1.3 Engineering Controls:**

**1.3.1** PVA must be handled to minimize particle contamination. Filtration through 0.45 micron membranes is recommended for a clean room preparation. Filtration must occur before bringing to clean room.

**1.3.2** BR must be handled to minimize contamination from bacteria in the environment. Use only clean pipette tips and Eppendorf tubes and wear gloves when handling.

**1.3.3** All solutions of PVA, BR, and PPS to be used should be prepared before entering the clean room.

**1.4 Personal Protective Equipment:** Protective eyewear and nitrile gloves are required.

## **2.0 Procedure: Spin coating PVA/BR/PPS thin films**

- 2.1 Prepare solutions of PVA/BR/PPS in 1.5 mL Eppendorf tubes before entering clean room
  - 2.1.1 0.5 mL of solution is sufficient for spin coating on a standard glass slide
    - 2.1.1.1 Typical: 0.2 mL 15% PVA, 0.05 mL 5% PPS, 0.2 mL 2 mg/mL BR – concentrations to be varied slightly
- 2.2 When spin coating silk be sure to use the ‘dirty’ spin coater (SU-8 spin coater)
  - 2.2.1 See Laurell Spinner SOP for more information on spin coating
  - 2.2.2 To spin coat PVA solutions use glass slide adapter for spin coater
  - 2.2.3 Start at 200 rpm for 3 s
  - 2.2.4 Go to 500 rpm in 3 s
  - 2.2.5 Spin at 500 rpm for 2 s
  - 2.2.6 Ramp to 500-5000 rpm in 3 s
  - 2.2.7 Then spin at 500 – 5000 rpm for 10 – 45 s depending on the film thickness desired.
- 2.3 Thin film drying may be required after processing. Appropriate drying procedures are unknown at the time of this writing.
- 2.4 When finished using PVA, and PPS clean exposed materials with water and fab wipes to remove PPS residue from tools. Then clean with isopropanol and fab wipes to remove PVA and BR residue. Dispose of fab wipes in solvent waste.

---

## **3.0 Storage:**

- 3.1 PVA should be stored in a clean room approved container under refrigeration when not in use.
- 3.2 BR and PPS solutions should be stored in a clean room approved container under refrigeration. Lack of refrigeration will lead to degradation of the protein and detergent respectively.

## **4.0 Waste Disposal:**

- 4.1 PVA, BR, PPS
  - 4.1.1 Solid waste for BR should go directly into uncontaminated trash unless other hazardous chemicals have been used in conjunction with the BR. BR are proteins and poses no health or environmental issues and readily biodegrade over time. BR is a very expensive material, so waste should be avoided. Only bring as much as you need.
  - 4.1.2 PPS is a small organic surfactant. BR and PVA containing PPS should be disposed of as solvent waste.
  - 4.1.3 PVA is a polymer and can be disposed of in a similar way to PDMS
    - 4.1.3.1 Liquid waste should go in the solvent/photoresist trash
    - 4.1.3.2 Solid waste should go in the solvent/photoresist trash

---

## **5.0 Accident Procedures:**

**5.1 Contact:** Read MSDS prior to working with any chemical to familiarize yourself with the symptoms of exposure and recommendations for treatment.

**5.1.1** Chemical one:

**5.1.1.1** Skin contact: Wash exposed area with water

**5.1.1.2** Eye contact: Wash eyes with water

**5.1.1.3** Ingestion: No adverse effects should result. Contact health professional if any symptoms persist.

**5.1.1.4** Inhalation: Remove exposed individual from area and contact health professional if necessary.

**5.2 Spill:**

**5.2.1** If a small, contained spill occurs, such as inside the hood, wipe it up with chemical wipes and dispose of in the appropriate trash container.

**5.2.2** If a large spill occurs that you are not comfortable cleaning up:

**5.2.2.1** If it is a large **PVA, BR, PPS** spill, Wipe spill up with absorbent material and dispose of in appropriate disposal container. Note that the material used to clean up the spill is likely more hazardous than the chemicals. Accordingly, use this material's MSDS to determine the proper disposal location. Notify the Tufts emergency services (x66911) immediately. Also notify the faculty advisor. Note that only small mL quantities will be used so large spills are very unlikely

If at any time you feel a situation is dangerous, do not hesitate to call the safety office (x73246, Peter Nowak) or the faculty supervisor (x72210, Robert White).

**Report all accidents (injuries, major spills, fires) to the safety office at x73246 (Peter Nowak) and the faculty supervisor at x72210 (Robert White). For emergencies, call Tufts Emergency Services at x66911.**