

SPEEDMIXER APPLICATION FOR ELECTRODE SLURRY MIX

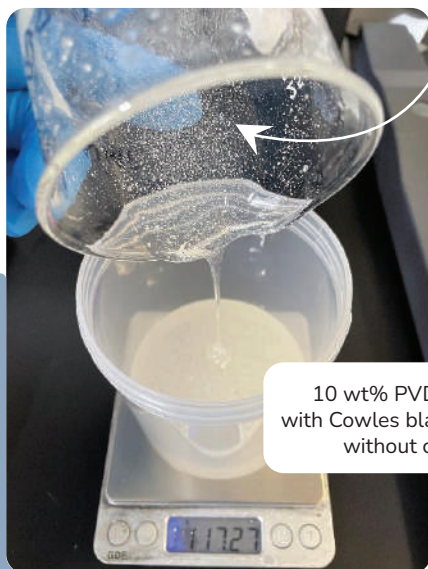
Dry Blending and Grinding

- Dry blending, with or without grinding media, of active materials with conductive additives and/or graphite for improved dispersion in composite slurry and enhanced electrical conductivity – particularly useful with nano-sized actives
- Dry mixing of powders without grinding media to break up clumps for improved incorporation into slurry and dispersion – “gentle” technique, helpful when primary particle damage should be avoided
- Grinding with ZrO beads or other media to break up stubborn agglomerates and/or reduce primary particle size

Degassing of Viscous Solutions

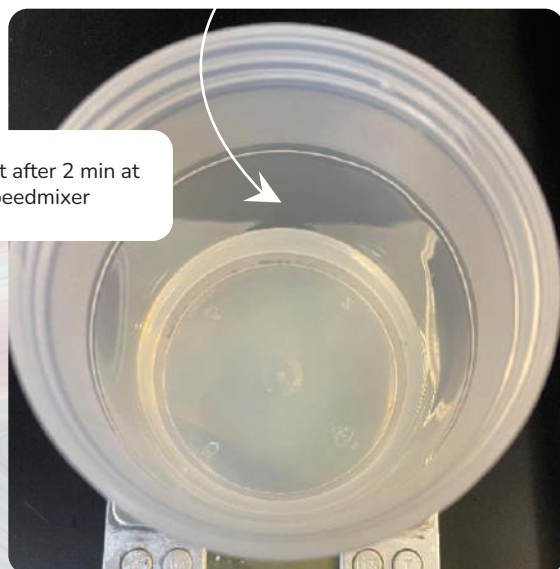
- For most solutions, 2 min at 2000 RPM in Speedmixer (no vacuum) eliminates air bubbles more quickly and effectively than vacuum cycling without centrifugal mixing
- Applying vacuum while mixing with Speedmixer degasses more stubborn solutions

Persistent small bubbles give solution translucent appearance



10 wt% PVDF in NMP, dissolved with Cowles blade mixer and degassed without centrifugal mixing

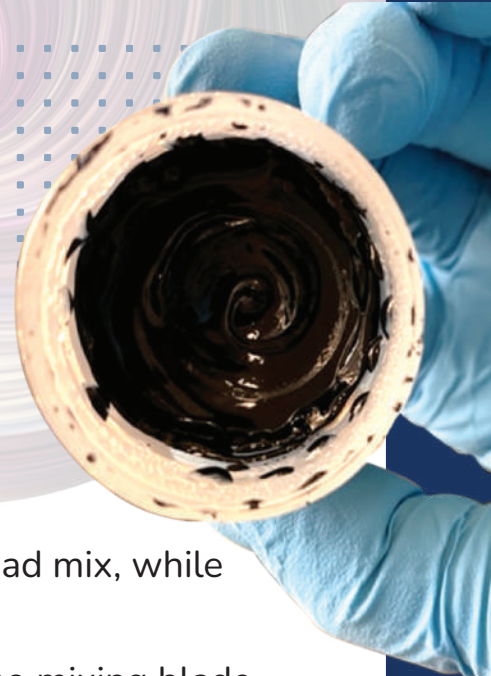
Solution completely clear after Speedmixer degas



Solution shown at left after 2 min at 2000 RPM in Speedmixer

Slurry Preparation – Incremental Dilution Method

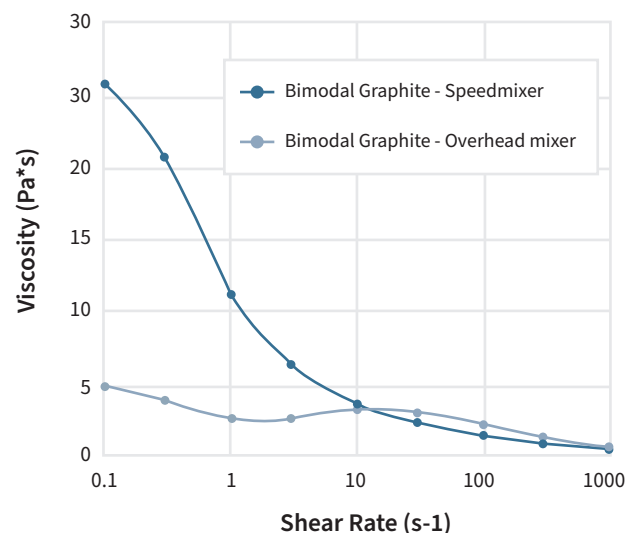
- Prepare at high solids content to create a uniform paste, incrementally dilute with solvent to achieve favorable rheological properties
- Generally faster and often better dispersion than slurry preparation with overhead mixer
- No issues with entrained air
- Usually results in higher solids mass fraction than overhead mix, while maintaining “coatable” viscosity
- Improved slurry yield compared with overhead mixing – no mixing blade related losses, reduced slurry adhesion to vessel walls compared with glass beaker



Slurry Preparation with High Surface Area Materials

- Improved rheological properties with high surface area materials, e.g. bimodal graphite for fast charge applications
- Reproducible shear-thinning properties observed in Speedmixer prepared slurry
- Oddly low viscosity at low shear rates for Overhead mixed slurry, with shear-thickening above 1 s⁻¹ – this can cause serious problems with scale-up
 - ▶ attributed to entrained air that could not be removed via vacuum degassing

Viscosity Profiles of Similar Aqueous Bimodal Anode Formulation



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