

## STUDY OF THE SYNTHESIS OF POLYALDEHYDES VIA ORGANOCATALYTIC ANIONIC POLYMERIZATION

Rueben Pfukwa,\* Inge Weideman and Bert Klumperman

Department of Chemistry and Polymer Science, Stellenbosch University, South Africa

Email: [rueben@sun.ac.za](mailto:rueben@sun.ac.za)

### ABSTRACT

Polyaldehydes (PA), in particular poly(phthalaldehyde) (PPA), are an interesting class of self-immolative polymers.<sup>1</sup> PAs have very low ceiling temperatures ( $T_c$ ); e.g. for PPA,  $T_c = -40$  °C, hence PAs have to be stabilized by end-capping to be stable above room temperature and enable one to process the polymer materials.<sup>2,3</sup> PAs depolymerize completely in response to a specific stimulus, either chemical or physical, which removes the end-caps.<sup>1</sup> Due to this PAs are interesting responsive materials, with a range of applications, including as responsive materials.<sup>1,4</sup> PAs can be synthesized via anionic, cationic and coordinative mechanisms.<sup>5-7</sup> Strategies which utilize organometallic catalysts are least popular because of possible contamination from residual metal ions. Recent studies utilizing metal-free phosphazene bases, have been successful, enabling access to PAs, with good agreement between theoretical and experimental molar masses.<sup>2,5</sup> However,  $\bar{D}$  values are often high,<sup>2</sup> and specialized conditions, e.g. use of glove box, are always required. There is a need therefore to further enhance the appeal of these materials by elaborating simple synthesis strategies for accessing PAs. Towards this goal we have carried out a detailed study, on the synthesis of the PAs, by anionic polymerization, using a range of organic superbases,<sup>8,9</sup> assessing the effect of each base on predictability of molar mass,  $\bar{D}$ , as well as the effects of solvent polarity and monomer concentration, on the polymerization.

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### References:

- <sup>1</sup>Peterson, G. I.; Larsen, M. B.; Boydston, A. J. *Macromolecules* **2012**, *45*, 7317.
- <sup>2</sup>DiLauro, A. M.; Robbins, J. S.; Phillips, S. T. *Macromolecules* **2013**, *46*, 2963.
- <sup>3</sup>Esser-Kahn, A. P.; Odom, S. A.; Sottos, N. R.; White, S. R.; Moore, J. S. *Macromolecules* **2011**, *44*, 5539.
- <sup>4</sup>DiLauro, A. M.; Zhang, H.; Baker, M. S.; Wong, F.; Sen, A.; Phillips, S. T. *Macromolecules* **2013**, *46*, 7257.
- <sup>5</sup>De Winter, J.; Dove, A. P.; Knoll, A.; Gerbaux, P.; Dubois, P.; Coulembier, O. *Polym. Chem.* **2014**, *5*, 706.
- <sup>6</sup>Ito, H.; Schwalm, R. J. *Electrochem. Soc.* **1989**, *136*, 241.
- <sup>7</sup>Yasuda, H.; Tani, H. *Macromolecules* **1973**, *6*, 303.
- <sup>8</sup>Boileau, S.; Illy, N. *Prog. Polym. Sci.* **2011**, *36*, 1132.
- <sup>9</sup>Kaljurand, I.; Kütt, A.; Sooväli, L.; Rodima, T.; Mäemets, V.; Leito, I.; Koppel, I. A. *J. Org. Chem.* **2005**, *70*, 1019.