

Poly(N-vinylpyrrolidinone) as Moisture-Sorbing Material for Relative Humidity Sensors

Elisabetta Ranucci, Paolo Ferruti, Paola Opelli,
Vittorio Ferrari¹, Daniele Marioli¹ and Andrea Taroni¹

Department of Mechanical Engineering, University of Brescia Via Branze 38, 25133 Brescia, Italy

¹Department of Electronics for Automation, University of Brescia Via Branze 38, 25133 Brescia, Italy

(Received March 26, 1993; accepted August 10, 1993)

Key words: quartz microbalance, mass resonant sensor, polymeric coating, hydrophilic polymer, relative humidity

Poly(N-vinylpyrrolidinone) was investigated as a possible coating in relative humidity (RH) mass resonant sensors. Its water sorption capability when deposited as thin film ($< 0.5 \mu\text{m}$) was measured using a quartz crystal microbalance (QCM) system at different relative humidities and temperatures. A negligible hysteresis was observed in cyclic isothermal sorption experiments at four temperatures. The response time was on the order of 10 s.

1. Introduction

Increasing attention is being devoted to gravimetric resonant sensors for detecting and measuring low concentrations of chemical substances to be employed, for instance, in industrial processes, environmental control and biomedical tests.⁽¹⁾ In particular, hydrophilic polymeric coatings are useful for relative humidity (RH) determinations in the atmosphere.⁽²⁻¹¹⁾

In this paper we report our results on RH determinations using AT-cut quartz crystals coated with thin films ($< 0.5 \mu\text{m}$) of poly(N-vinylpyrrolidinone) (PVP). Among the commercially available synthetic hydrophilic polymers, PVP is widely recognized as a material endowed with good thermal and chemical stability.⁽¹²⁾ On the other hand, our preliminary experiments performed on PVP and other poly(N-vinyl lactames) in the form of thick films ($> 5 \mu\text{m}$) had previously shown that these