



UNIVERSITÀ POLITECNICA DELLE MARCHE FACOLTÀ DI MEDICINA E CHIRURGIA

Dipartimento Scienze Cliniche Specialistiche e Odontostomatologiche: XXXIII° ciclo

Polymerization kinetic of dual-cure resin cements

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**Nuovi orientamenti
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Why dual-cure resin cement?

The great development of dental adhesives and resin-based composites has allowed the development of resin-modified cements, increasingly used for the cementation of prosthetic restorations.

Dual-cure resin cements were developed to establish a reliable bond between the prepared tooth and restorative materials.



Prof. A. Putignano



The Aim

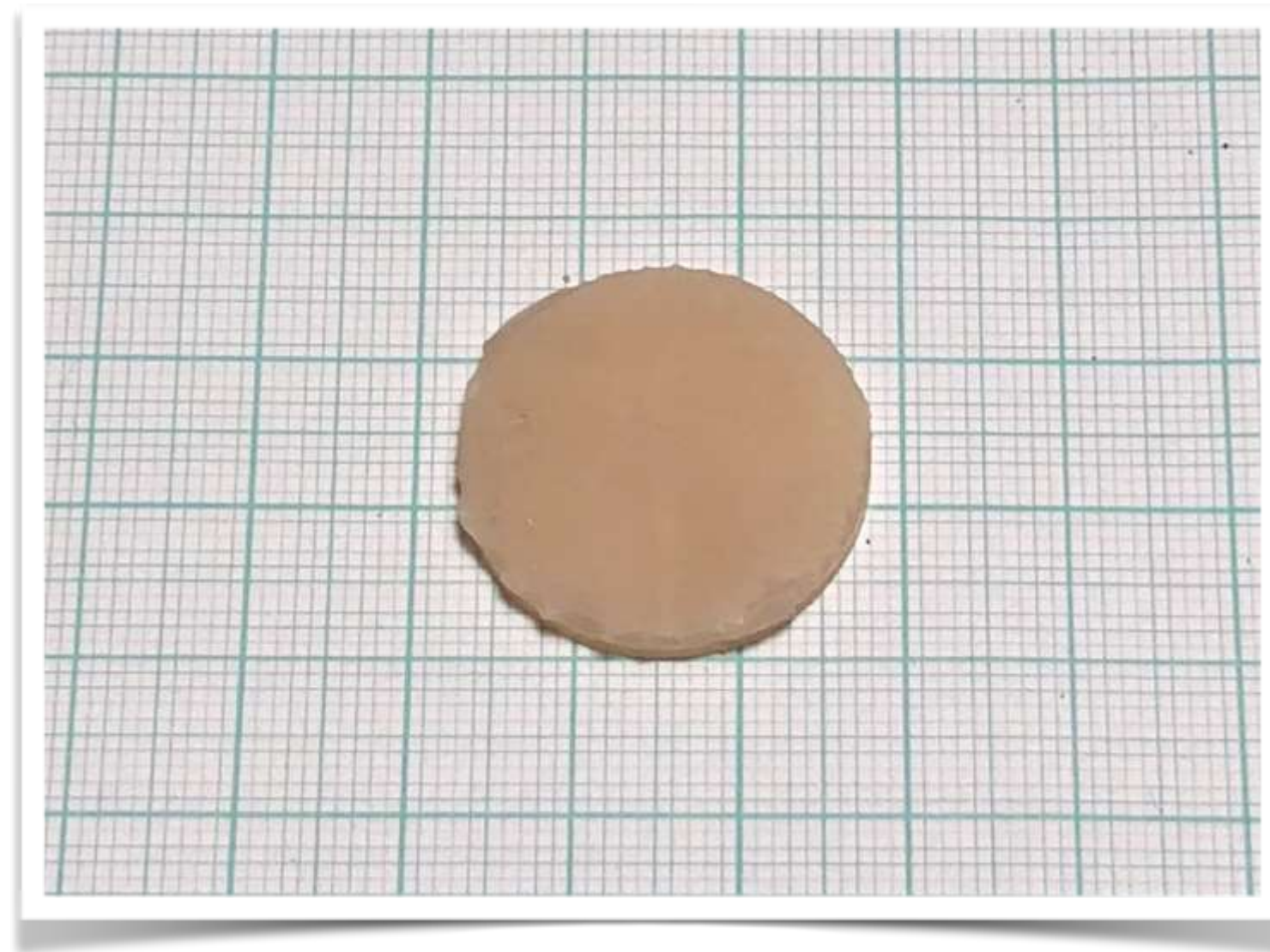
The purpose of this study is to evaluate the behavior and the performance of two dual-cure resin cements, through the analysis of their polymerization kinetic.

Materials & Methods

- Each material was placed on top of a 1.1mm thick Kalter slide and covered with another 0.2mm thick square glass to reach a material thickness of 0.2mm (200 μ m), by means of a ring-shaped Teflon spacer (200 μ m).



- 2 mm thickness composite disk (Filtek 3M color B6) was interposed between the sample and the lamp to simulate the in vivo polymerization.
- Light-curing lamp used for the polymerization of the samples is Elipar Deep Cure (3M ESPE).

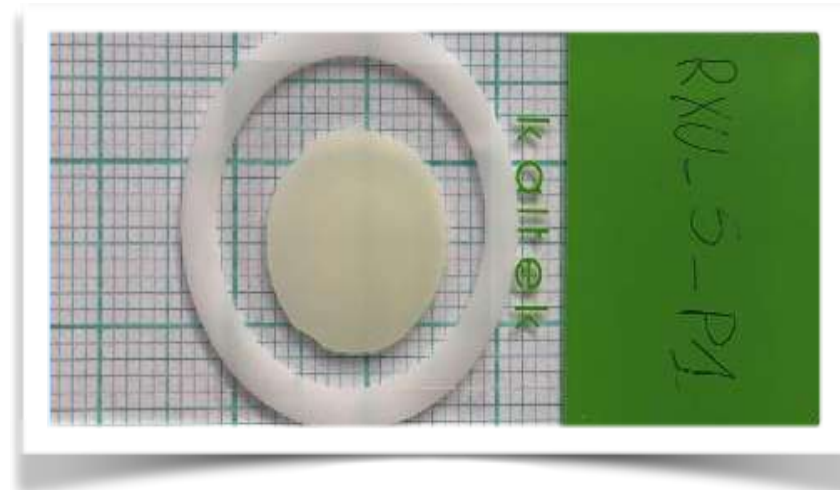


Materials	Manufacturer	Type	Composition
RelyX™ Ultimate	3M ESPE	Adhesive Resin Cement	<ul style="list-style-type: none"> • Base paste: Methacrylate monomers, radiopaque, slanted fillers, initiator components, stabilizers, rheological additives • Catalyst Paste: Methacrylate monomers, radiopaque alkaline (basic) fillers, initiator components, stabilizers, pigments, rheological additives, fluorescent dye, dark cure activator for scotchbond Universal adhesive.
NX3	Kerr Corp.	Third Generation Universal Resin Cement System	<ul style="list-style-type: none"> • Uncured methacrylate ester monomers, inert mineral fillers, activators and stabilizers, and radiopaque agent • Glycerine, water, fumed silica, and inert glass powder, gelatin.

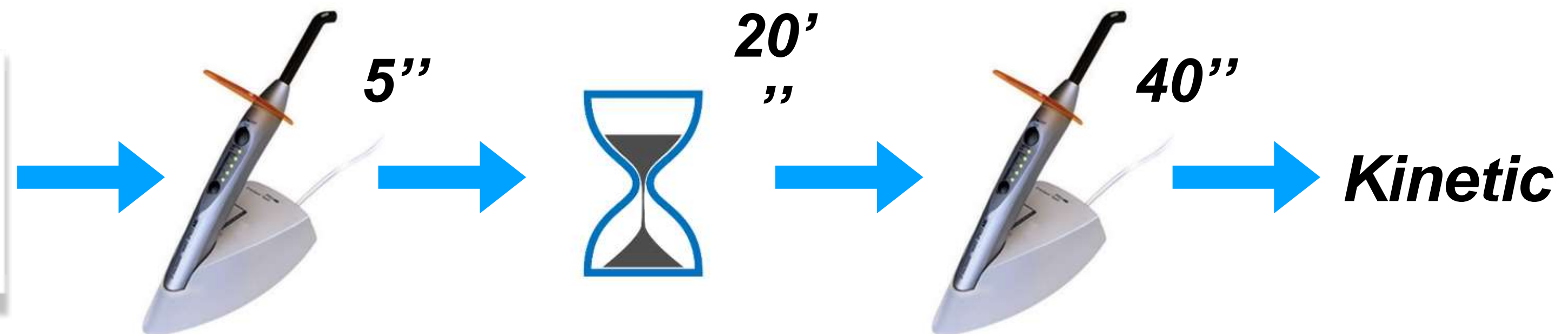
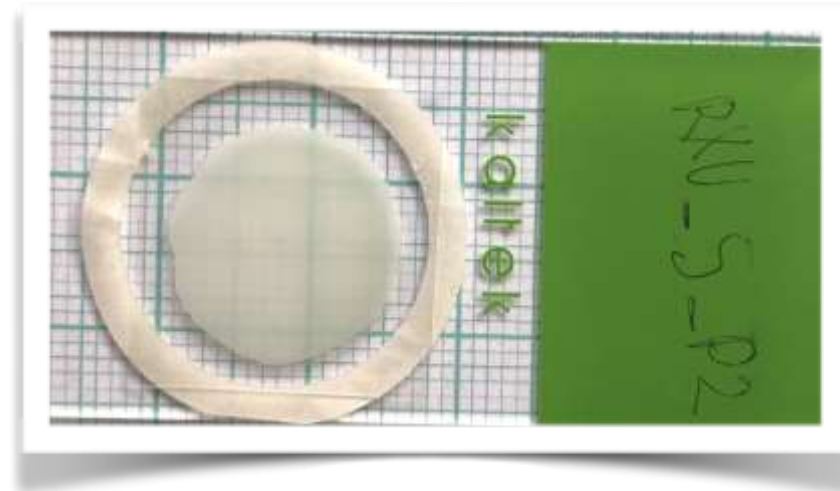


Protocols

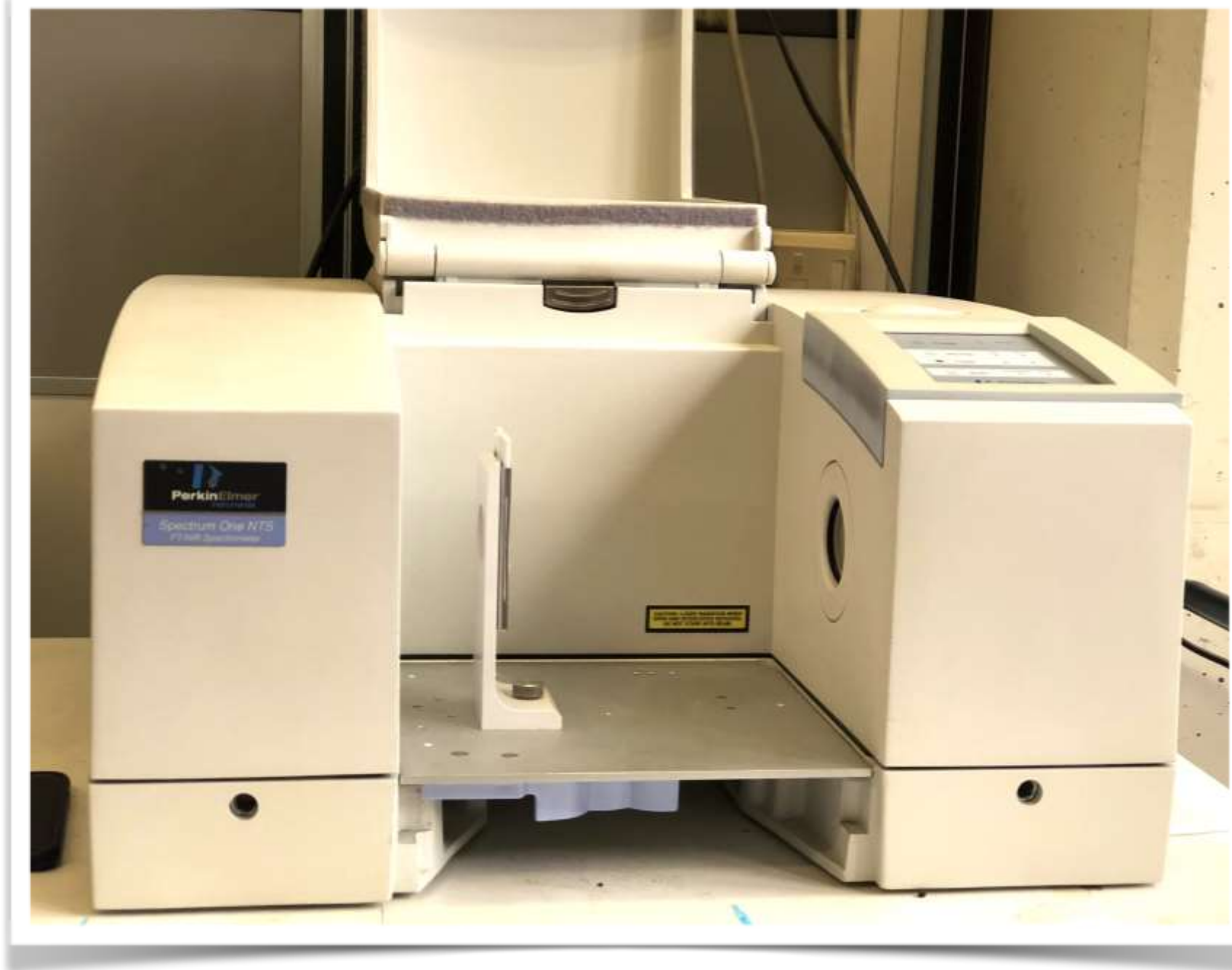
Protocol 1 (P1):
● Waiting 12 seconds after the positioning of the sample inside the NIR cavity.
● Curing time: 40 seconds.



Protocol 2 (P2):
● 12 seconds after the positioning of the sample inside the NIR cavity,
● Curing time: 5 seconds,
● Waiting 20 seconds,
● Curing time: 40 seconds.



FT-NIR spectrometer



Perkin Elmer Spectrum One NTS FT-NIR

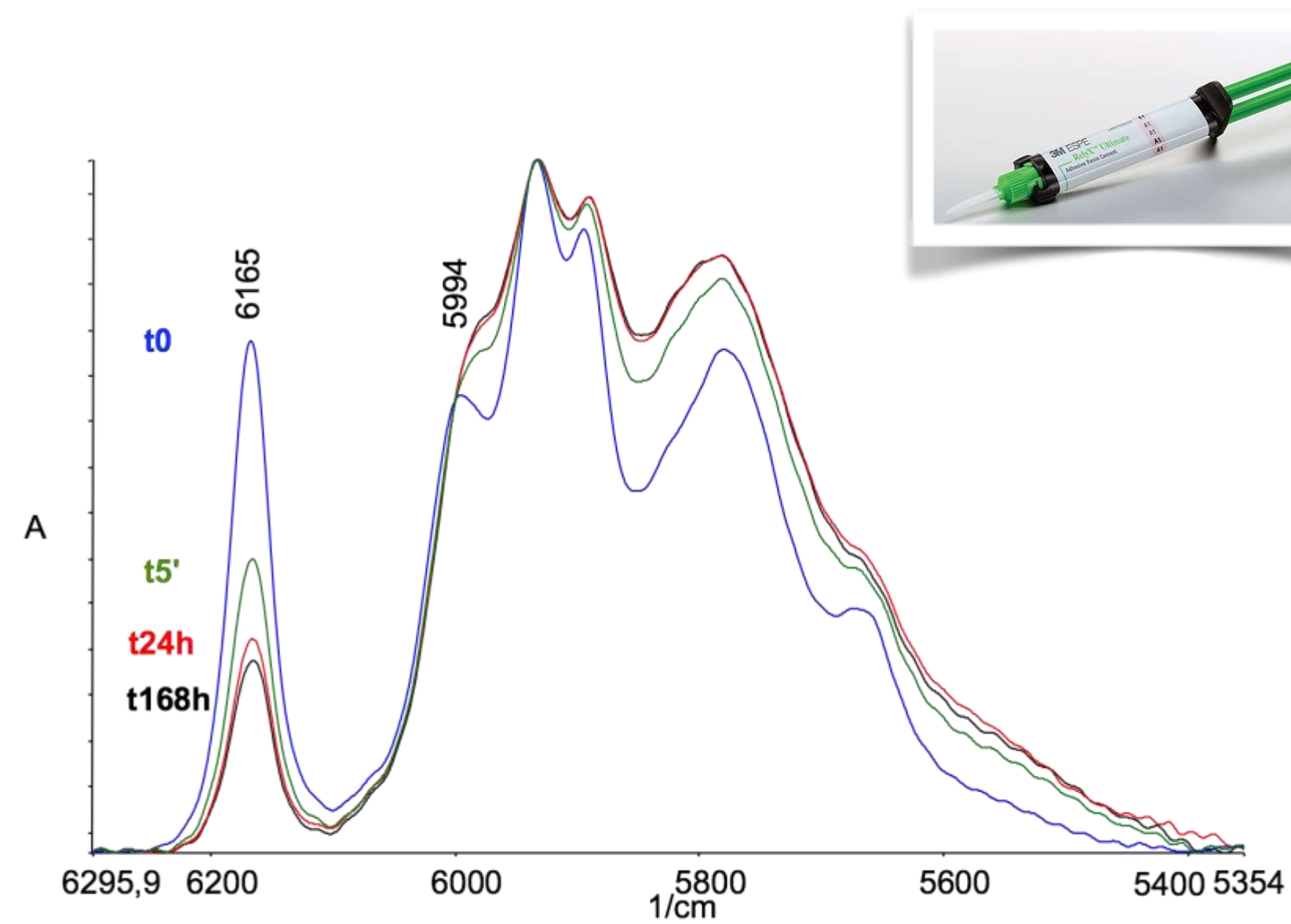
Spectral range: 7000-4000 cm^{-1}

Spectra resolution: 16 cm^{-1}

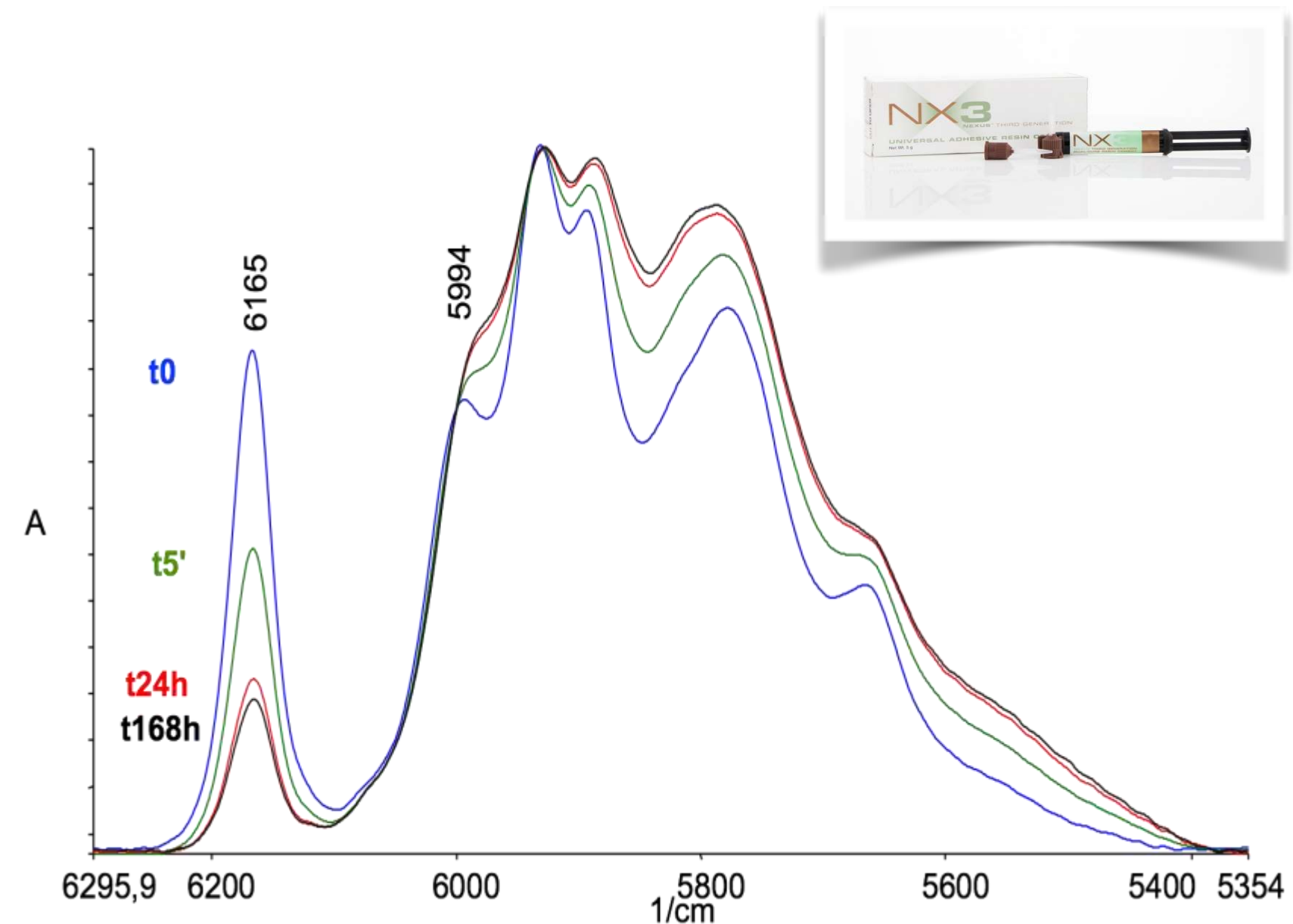
Analyzed bands:

- 6165 cm^{-1} (first overtone of C=C bond)
- 5994 cm^{-1} (aromatic ring vibrations, taken as internal standard)

RelyX Ultimate

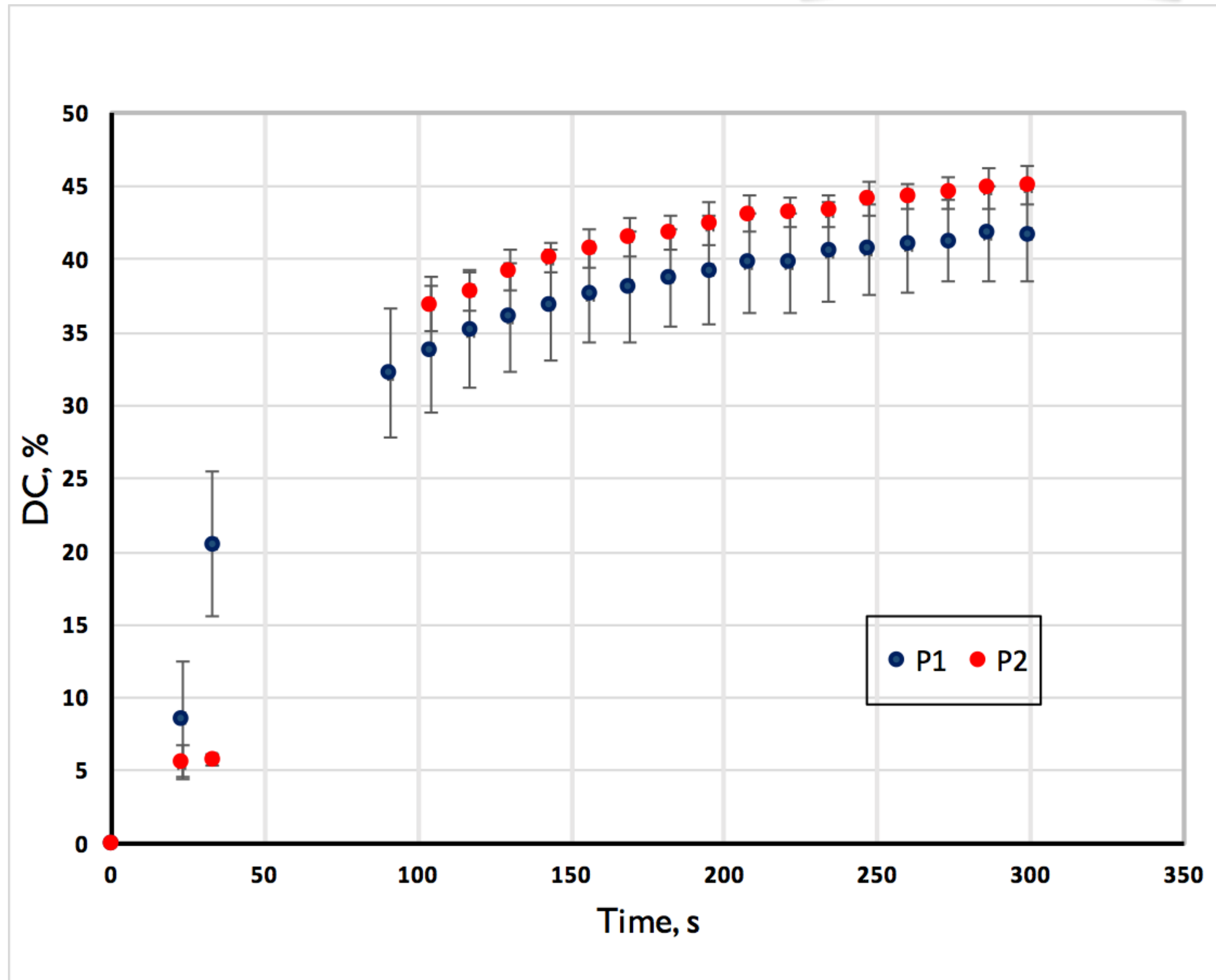


NX3

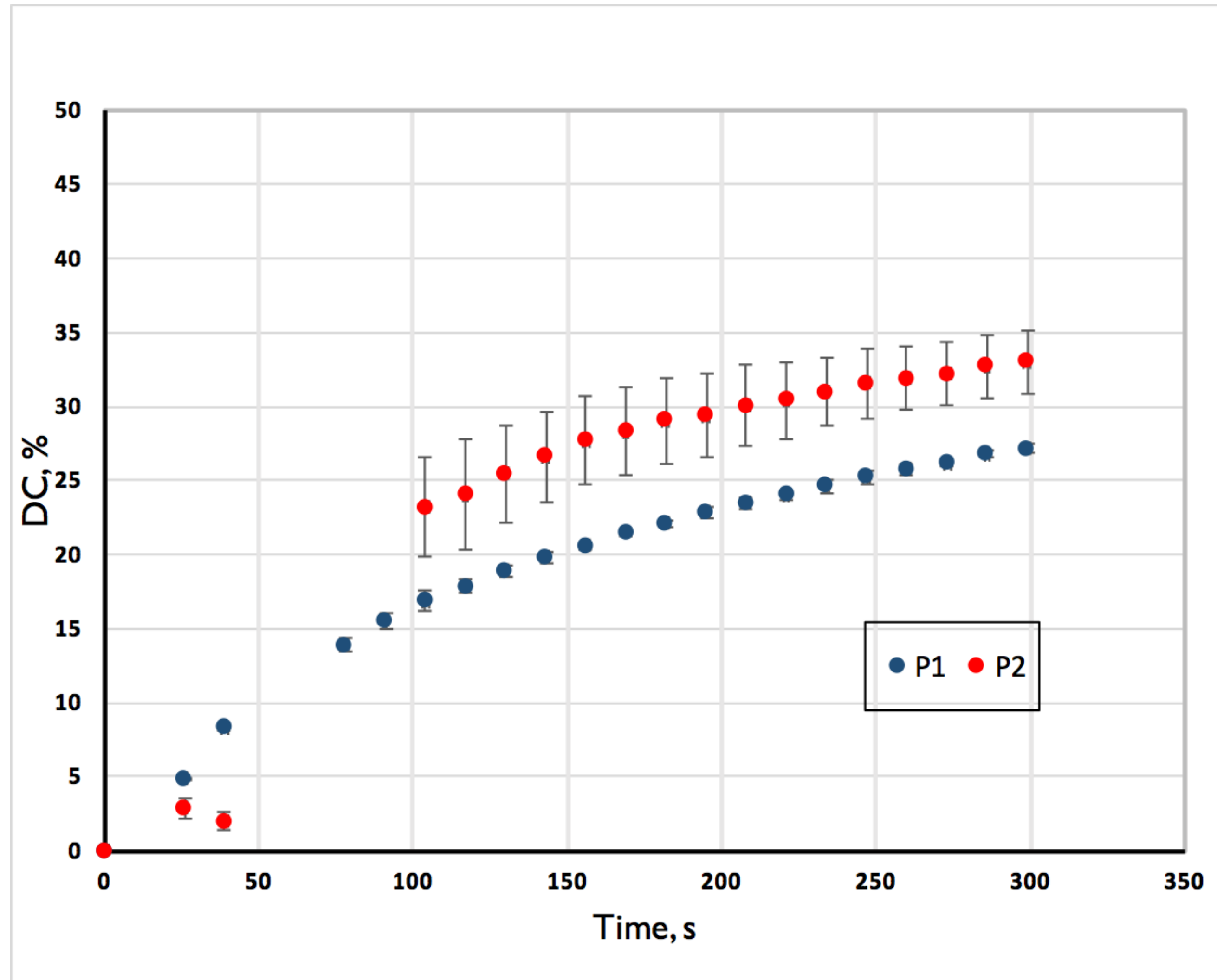


NIR absorbance spectra (6300-5400 cm^{-1}) of RelyX Ultimate and NX3 cured according to Protocol P1 (t₀, blue line; t_{5'}, green line; t_{24h}, red line, and t_{168h}, black line).

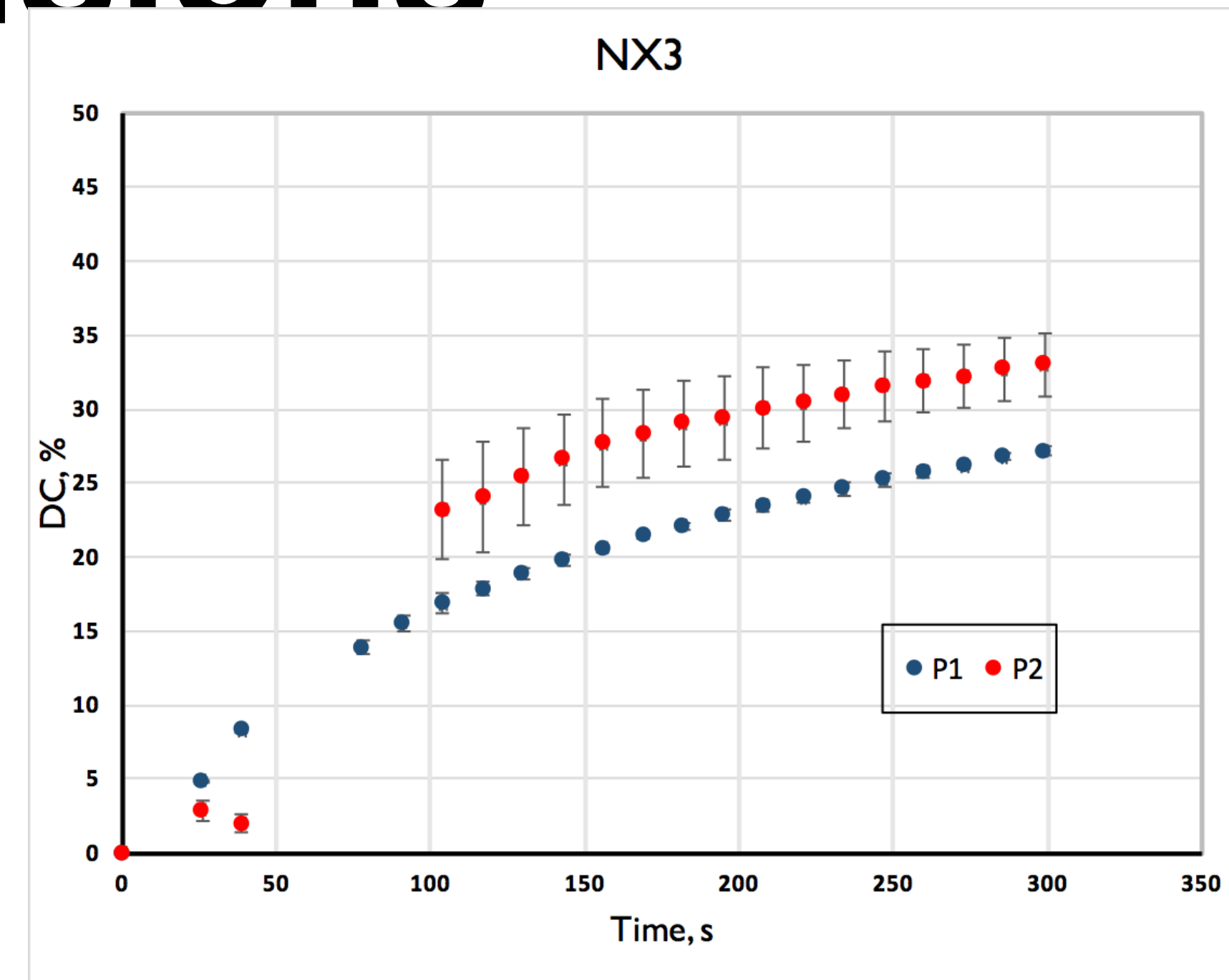
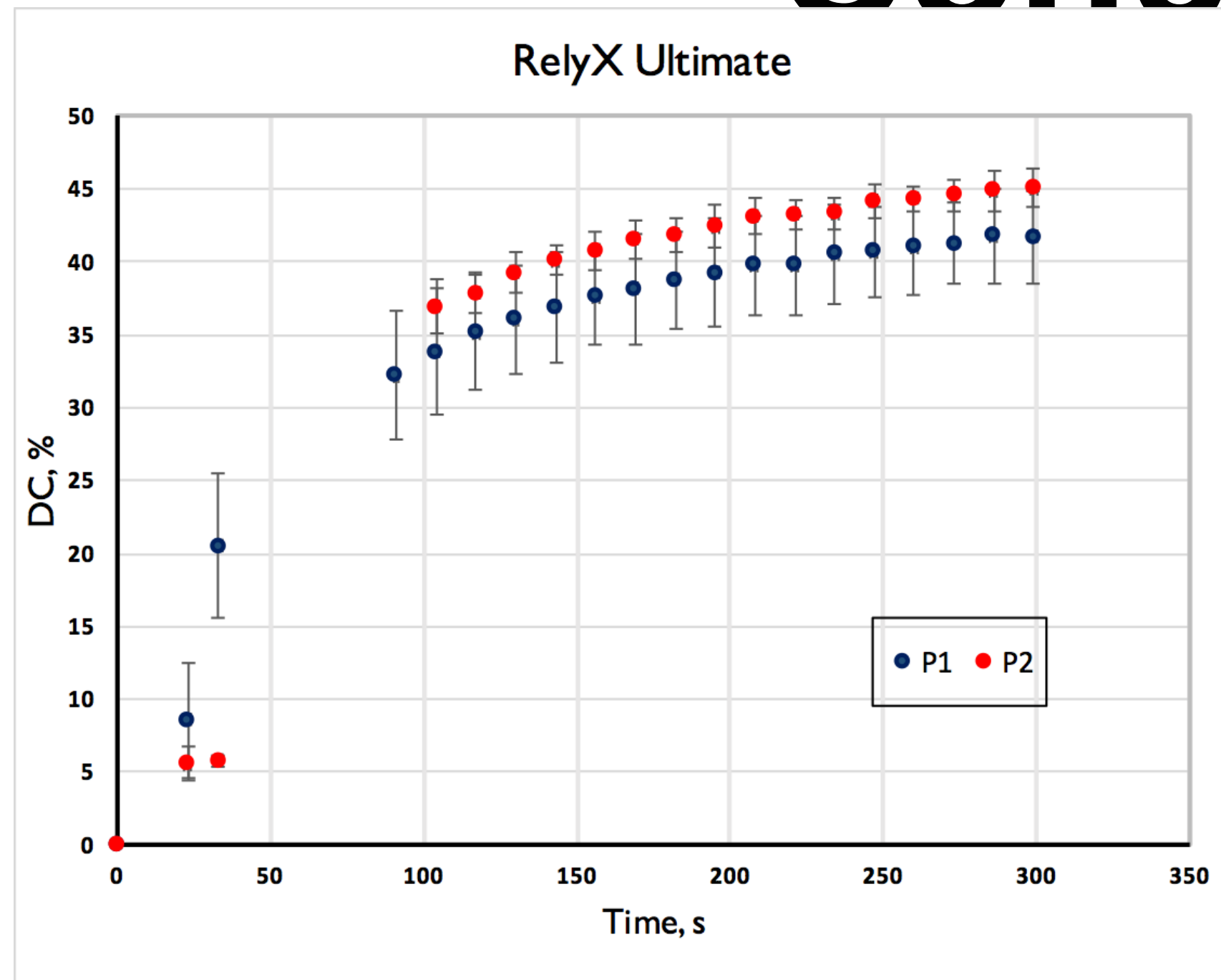
RelyX Ultimate



NX3



Conclusions



- At 300 s, RelyX Ultimate reaches a higher Degree of Conversion (DC) than NX3.
- In both cases, a 80% of DC is reached at longer times.
- In RXU cement, no significant differences of DC were found with both the protocols.
- In NX3 cement, P2 DC values resulted statistically different from P1 values at 300 sec in curing-light.



“Polymerization kinetic in dual-cure resin cements” Tosco et al.



Thank you

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