

Surface Nanotreatment of Silicon and Polyamide by Means of Atmospheric Microwave Plasma Jet



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Motivation

Surface activation \Rightarrow **increase of surface free energy**

Positive effects:

- wettability
- adhesion \Rightarrow dyeing, gluing, film deposition ...
- printability

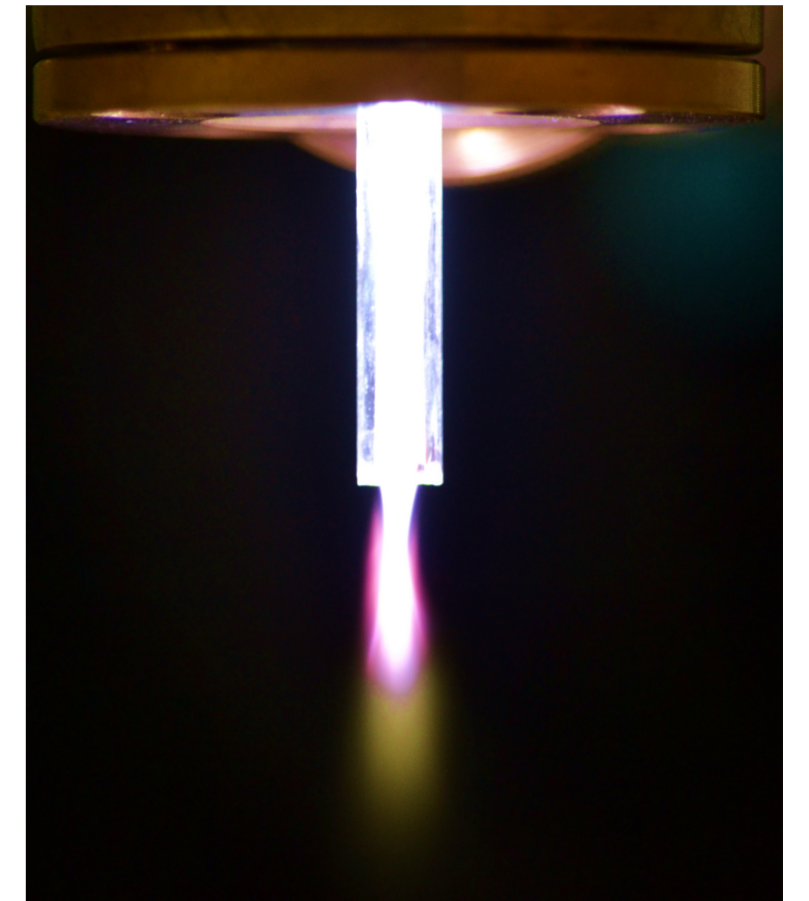
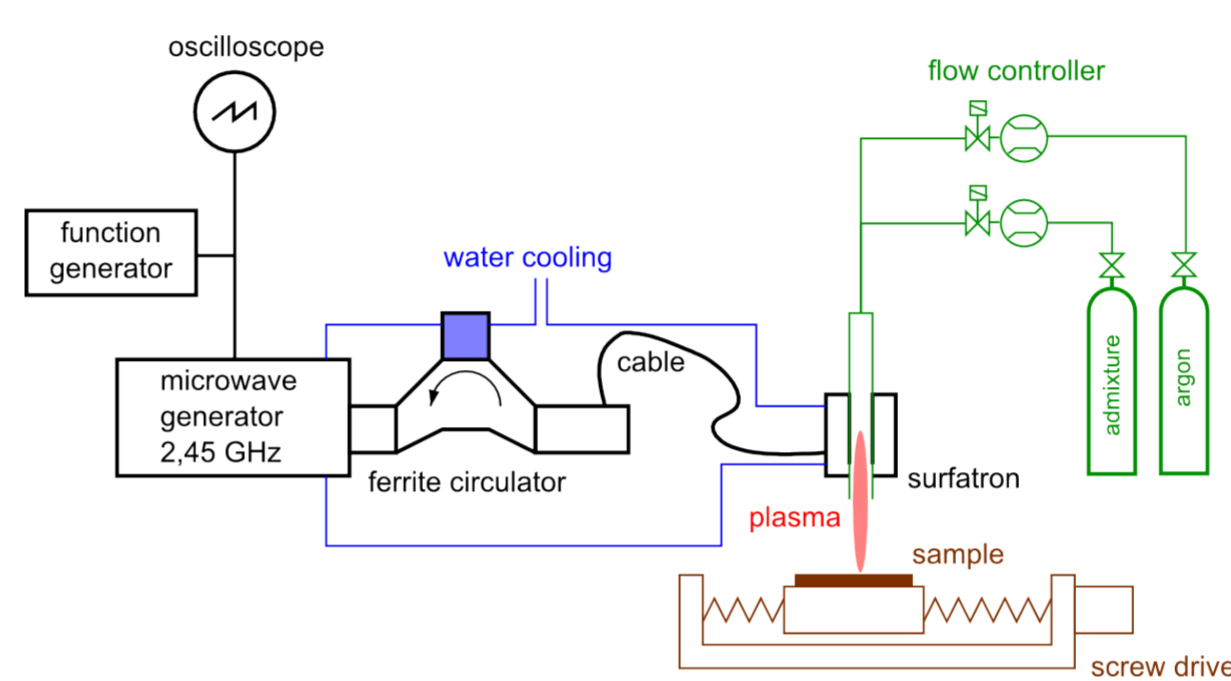
Special plasma device: surfatron

- atmospheric pressure
- localized plasma treatment
- treatment of rough or structured surfaces
- short treatment times
- treatment of low dielectric strength materials

Experimental setup

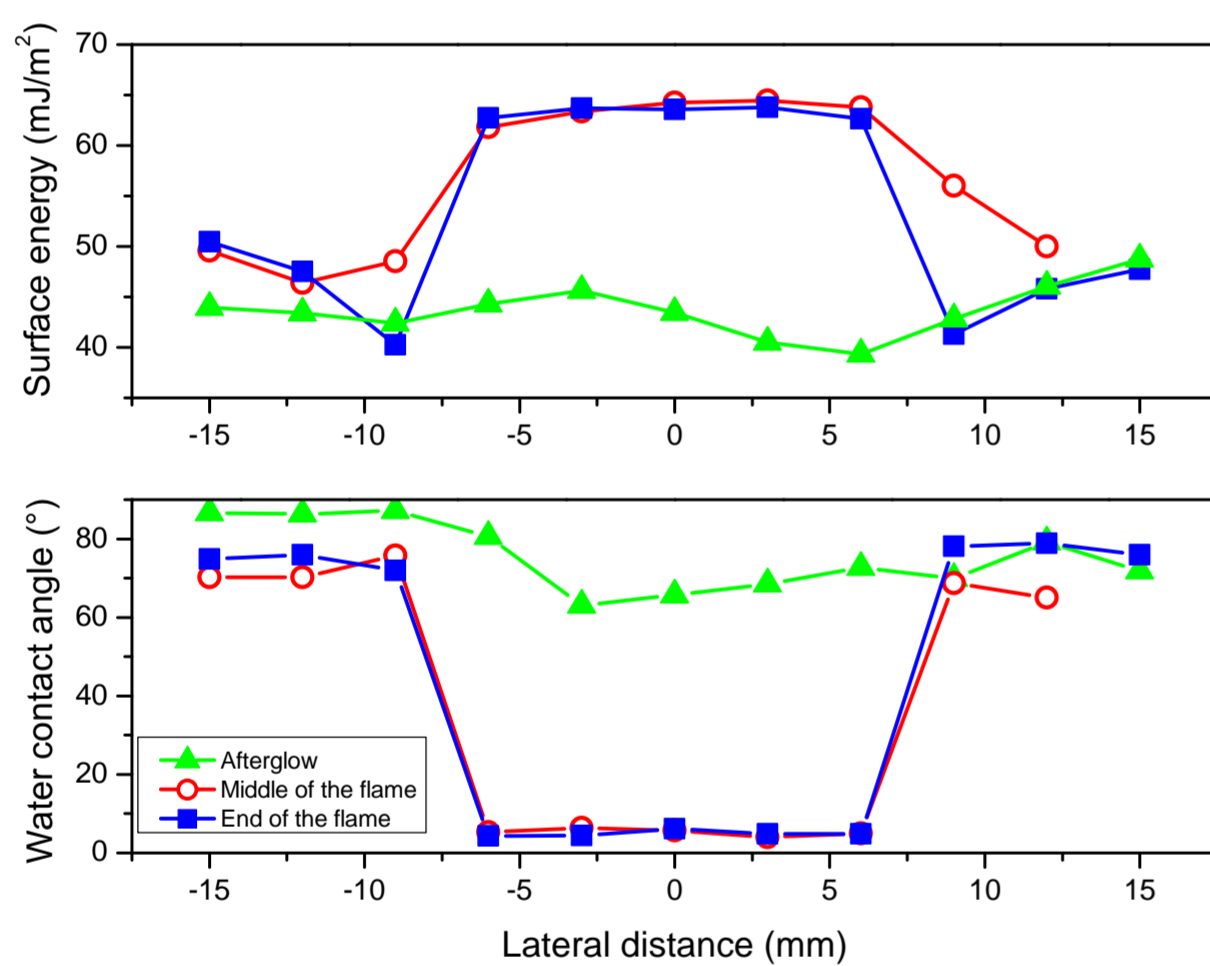
Fixed parameters

- Microwave (2.45 GHz) excitation
- $P = 250$ W (in both CW or AM modes)
- Working gas: argon (1.45 slm)
- Tube inner diameter = 1.5 mm

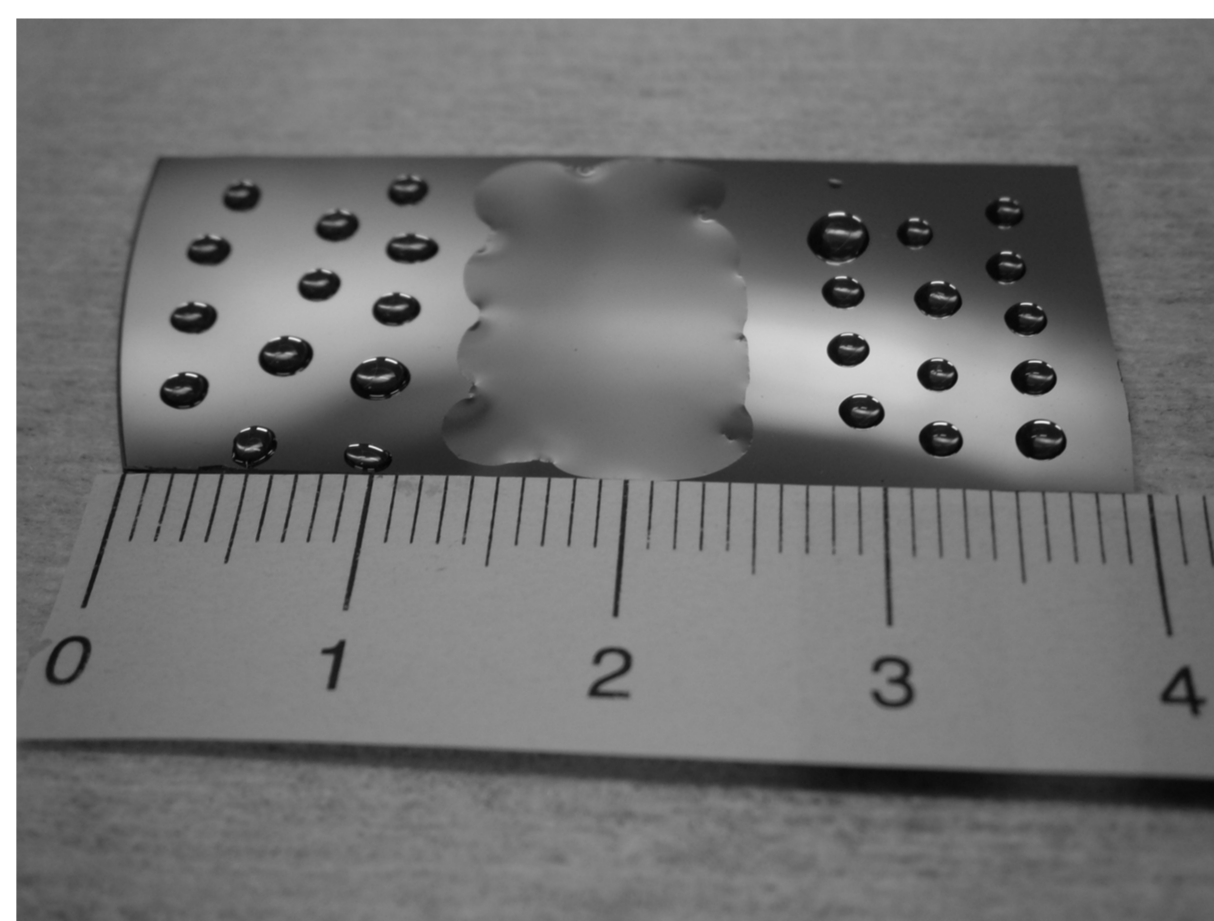


Silicon treatment

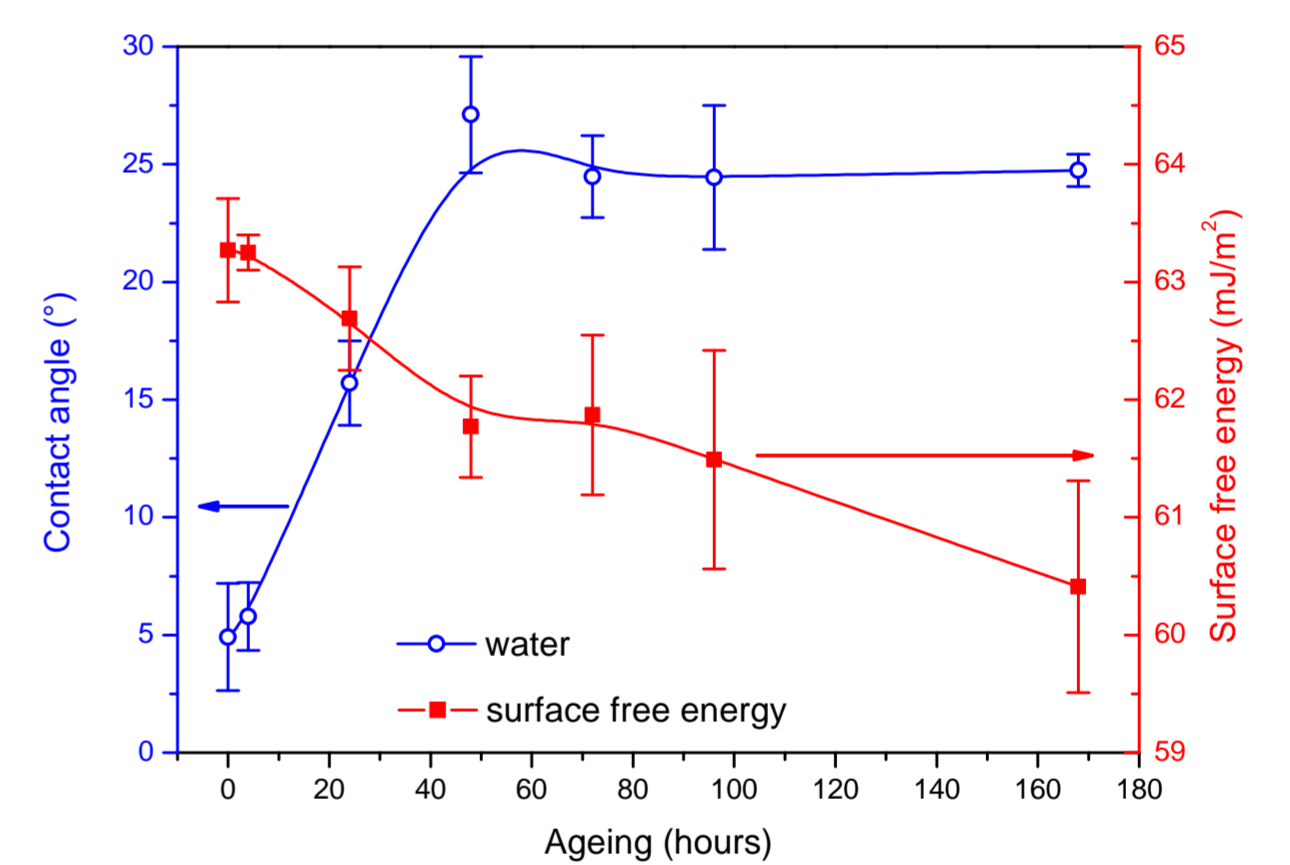
Profile



Si wafer surface treatment

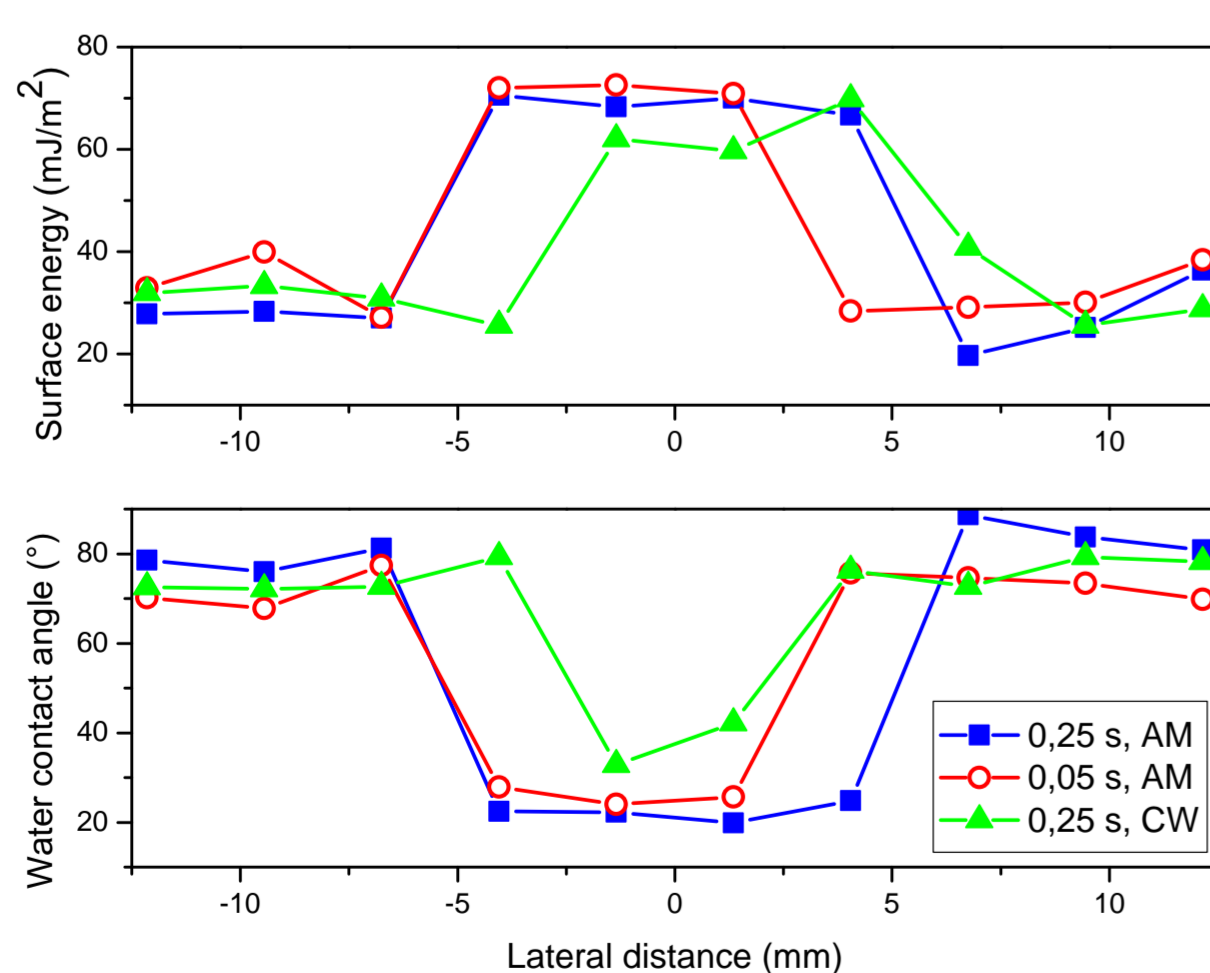


Ageing

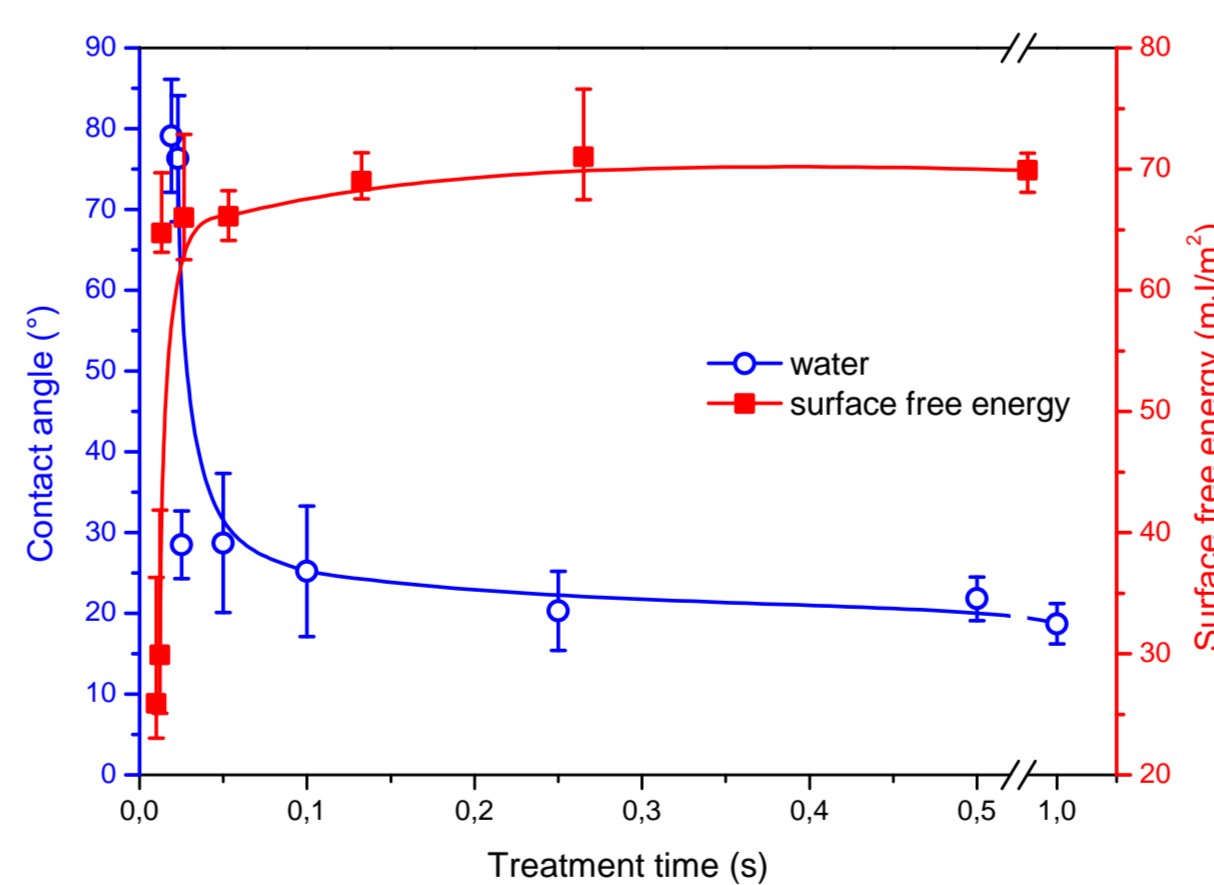


Polyamide treatment

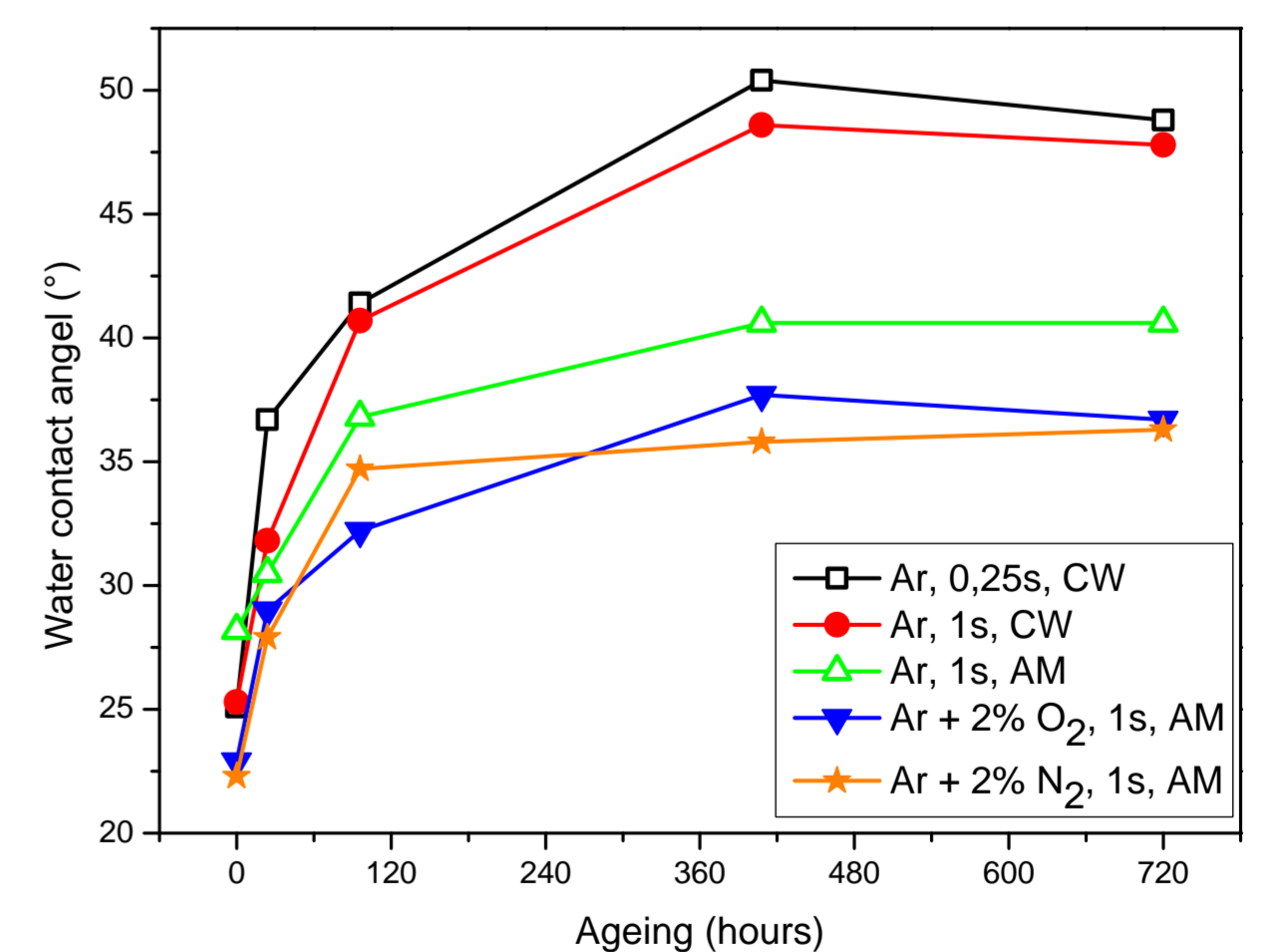
Profile



Short exposition time



Ageing



Conclusion - silicon

- water contact angle: $86^\circ \rightarrow 3^\circ$
- necessary time: < 0.019 s
- treatment width: < 1 cm (for amplitude modulated mode)
- ageing: $3^\circ \rightarrow 30^\circ$ in 10 days

Conclusion - polyamide

- water contact angle: $79^\circ \rightarrow 19^\circ$
- necessary time: > 0.05 s
- treatment width: < 1 cm (for amplitude modulated mode)
- ageing: $19^\circ \rightarrow 35^\circ$ in 30 days (for 2% nitrogen admixture)

Outlook

High-speed treatment

