

Layer-by-layer assembly of polymer-based microfluidic systems via plasma processes

Description

As the demand for microfluidic devices grows, developing complex systems in a flexible, cost-effective, and scalable manner gets increasingly critical. A promising approach involves using inexpensive, widely available thermoplastics like polycarbonate (PC), cyclic olefin copolymer (COC), and polymethyl methacrylate (PMMA). While these polymers offer multiple desirable properties, sealing chips made from them remains challenging, often requiring labor-intensive methods (e.g., adhesive bonding) or risking damage to microfluidic features (e.g., thermal bonding). Moreover, scalable production becomes more complex with the addition of functional layers, such as porous membranes needed for on-chip biological interfaces. To address these issues, this thesis explores plasma processes for the bonding thermoplastic polymers. Plasma treatment can enhance surface energy and introduce functional groups, therefore enabling controlled surface modification without compromising microchannels or membranes. This approach might reduce the fabrication complexity, labor, and costs associated with the scalable production of microfluidic systems.

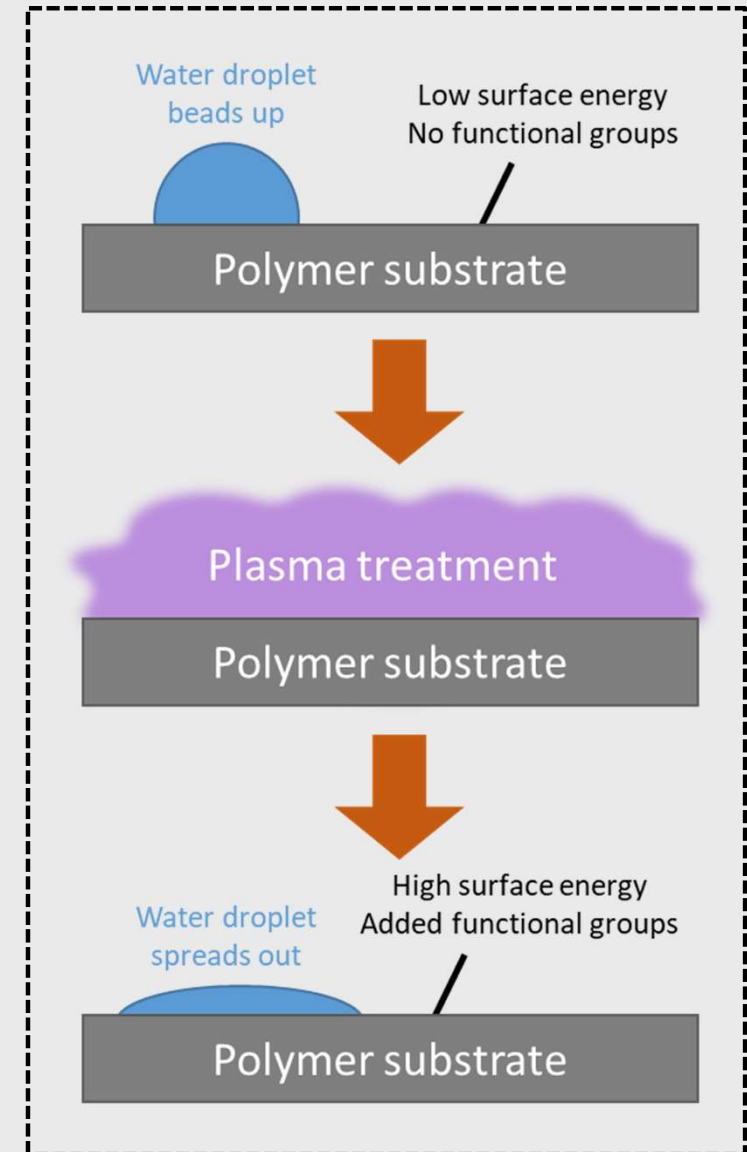
Requirements

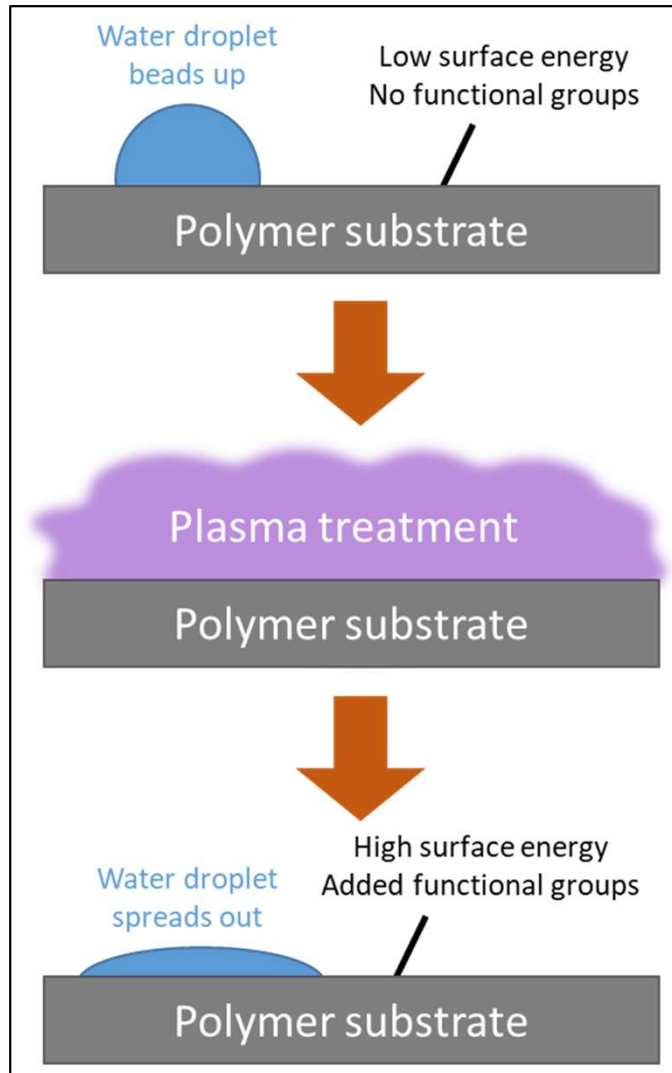
- Good English skills, both written and spoken
- Self-structured, disciplined work
- Willingness to travel to Fraunhofer IST regularly

Start: By arrangement

Contact: **Hazal Kutluk**
Phone.: 0531 391-65672
h.kutluk@tu-bs.de

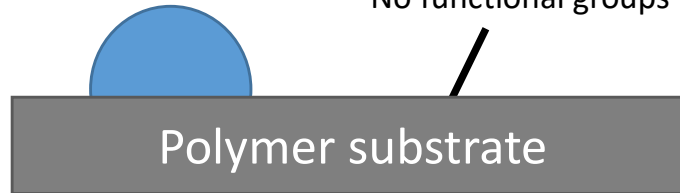
Dr. Kristina Lachmann
Phone.: 0531 2155-683
kristina.lachmann@ist.fraunhofer.de





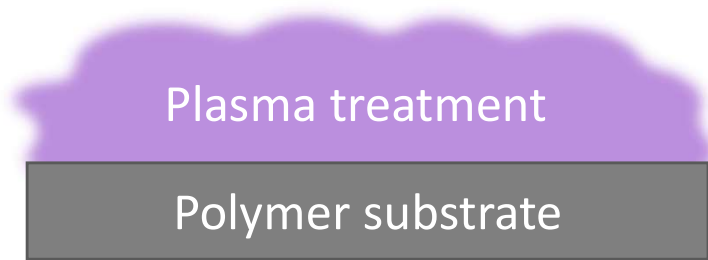
Water droplet beads up

Low surface energy
No functional groups



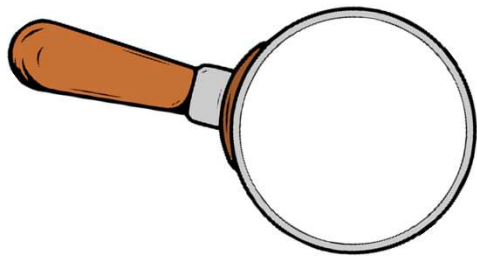
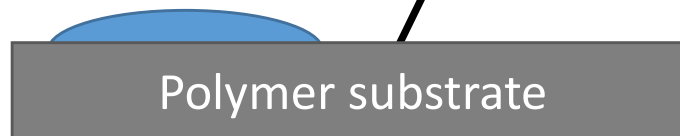
Plasma treatment

Polymer substrate



Water droplet spreads out

High surface energy
Added functional groups



Procedure for publication of the call for thesis

Steps for publication on the institute's website

1. Convert the Power Point to a pdf (see next slides).
2. Export the images from the Power Point slide into an image (e.g. png or jpg) (see next slides).
3. Write a short introductory text for the thesis (max. 2 sentences).
4. If videos are included in the call for thesis, convert the presentation into a video (duration: 30 sec!) (see next slides).
5. Send everything (pdf, video, image and introductory text) to the persons responsible for the website.
6. If desired: Print the call for thesis in DIN-A5 format (see next slides) and hang it on the poster next to the main entrance.



Convert the student call for thesis into pdf

Convert to pdf

The image shows a screenshot of the Microsoft Print to PDF printer settings dialog. A vertical red sidebar on the left contains various menu items: Informationen, Neu, Öffnen, Speichern, Speichern unter, Drucken, Freigeben, Exportieren, Schließen, Konto, and Optionen. The main area is titled 'Drucken' and includes a printer icon, a dropdown menu for 'Drucker' (currently showing 'Microsoft Print to PDF'), and an 'Einstellungen' section with options for 'Benutzerdefinierter Bereich', 'Folien' (set to 1), and 'Ganzseitige Folien' (set to '1 Folie pro Seite drucken'). Below this is a 'Drucklayout' section with icons for 'Ganzseitige Folien', 'Notizenseiten', and 'Gliederung', followed by a 'Handzettel' section with various grid patterns (1, 2, 3, 4, 6, 9 folien horizontal and vertical). At the bottom, there are checkboxes for 'Folienrahmen', 'Auf Seitenformat skalieren' (checked), 'Hohe Qualität', and 'Kommentare und Freihandmarkierungen drucken'.

Go to print settings →

Select "Microsoft Print to PDF" →

Print 1st page only →

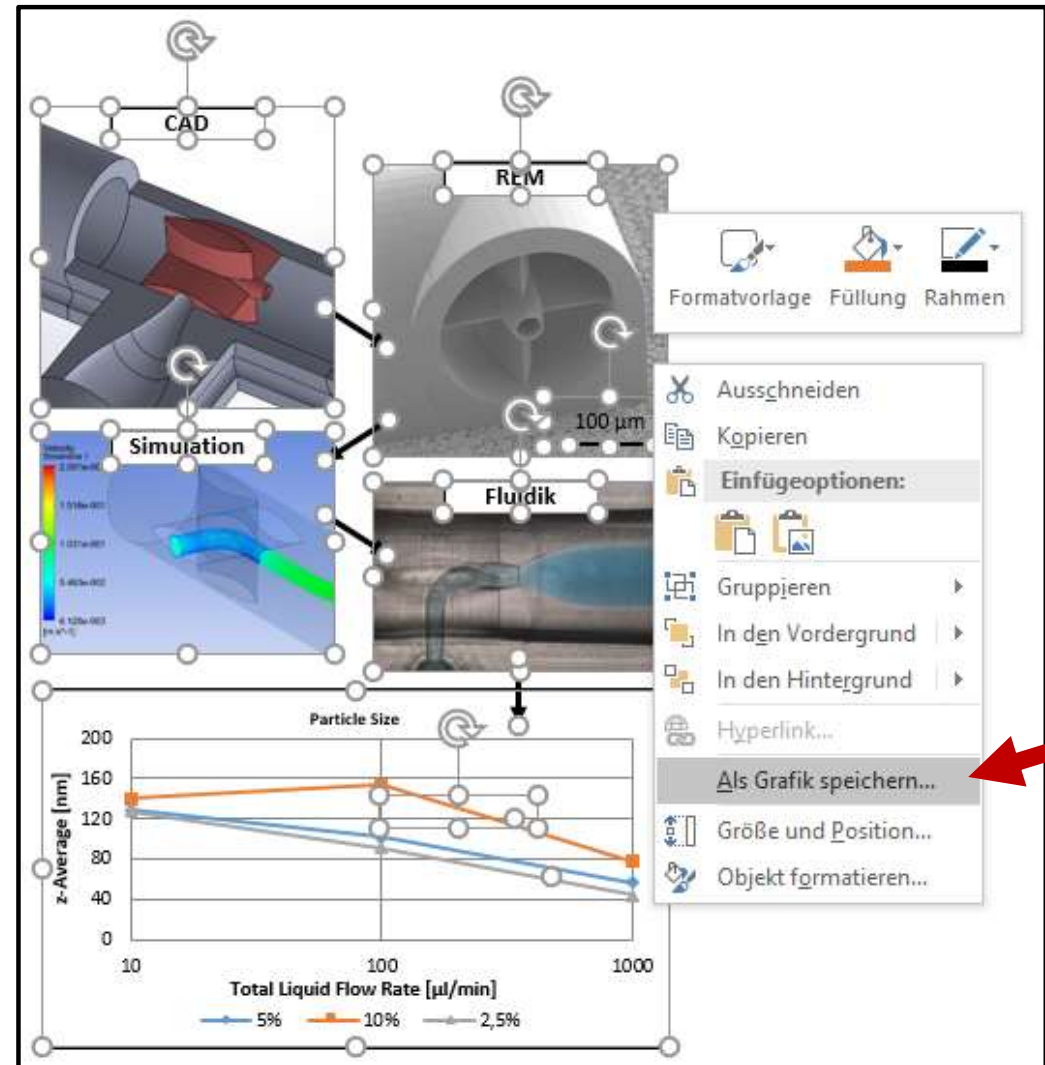
Scale to page format →



Export images from Power Point to png

1. Select the images in Power Point
2. Open the context menu
3. Select the "Save as graphic" option

Example



Printing of the student call for thesis

Printing from PowerPoint

Print 1st page only

Drucken

Exemplare: 1

Drucker

RICOH MP C2503 PCL 6
Wenig Toner

Druckereigenschaften

Einstellungen

Benutzerdefinierter Bereich
Zu druckende Folien einzeln...

Folien: 1

Ganzseitige Folien
1 Folie pro Seite drucken

Einseitiger Druck
Nur auf eine Seite des Blatts...

Sortiert
1;2;3 1;2;3 1;2;3

Keine Heftklammern

Farbe

Kopf- und Fußzeile bearbeiten

Set to DIN-A5 format

Eigenschaften von RICOH MP C2503 PCL 6

Ein-Klick-Voreinstell. Detail. Einstellungen Konfiguration/Info

Aktuelle Einstellung

Unregistriert

Dokumentenformat:
A5 (148 x 210 mm)
Druck auf:
Wie Vorlagenformat

Liste Ein-Klick-Voreinstellungen:

Grundeinstellung 2 auf 1 1-seitig

2 auf 1 (2-seitig) Schwarzweiß (2-seitig) Unregistriert

Jobtyp:
Normaldruck

Dokumentenformat:
A5 (148 x 210 mm)

Ausrichtung:
Querformat

Farbe/Schwarzweiß:
Farbe

Einzugsmagazin:
Automatische Magazinwahl

Papiertyp:
Normal & Recycling

Kopien:(1 bis 999)
1

OK Abbrechen Hilfe

Scale to page format

Drucken

Exemplare: 1

Drucker

RICOH MP C2503 PCL 6
Wenig Toner

Druckereigenschaften

Einstellungen

Benutzerdefinierter Bereich
Zu druckende Folien einzeln...

Ganzseitige Folien
1 Folie pro Seite drucken

Handzettel

1 Folie 2 Folien 3 Folien

4 Folien horizontal 6 Folien horizontal 9 Folien horizontal

4 Folien vertikal 6 Folien vertikal 9 Folien vertikal

Folienrahmen

Auf Seitenformat skalieren

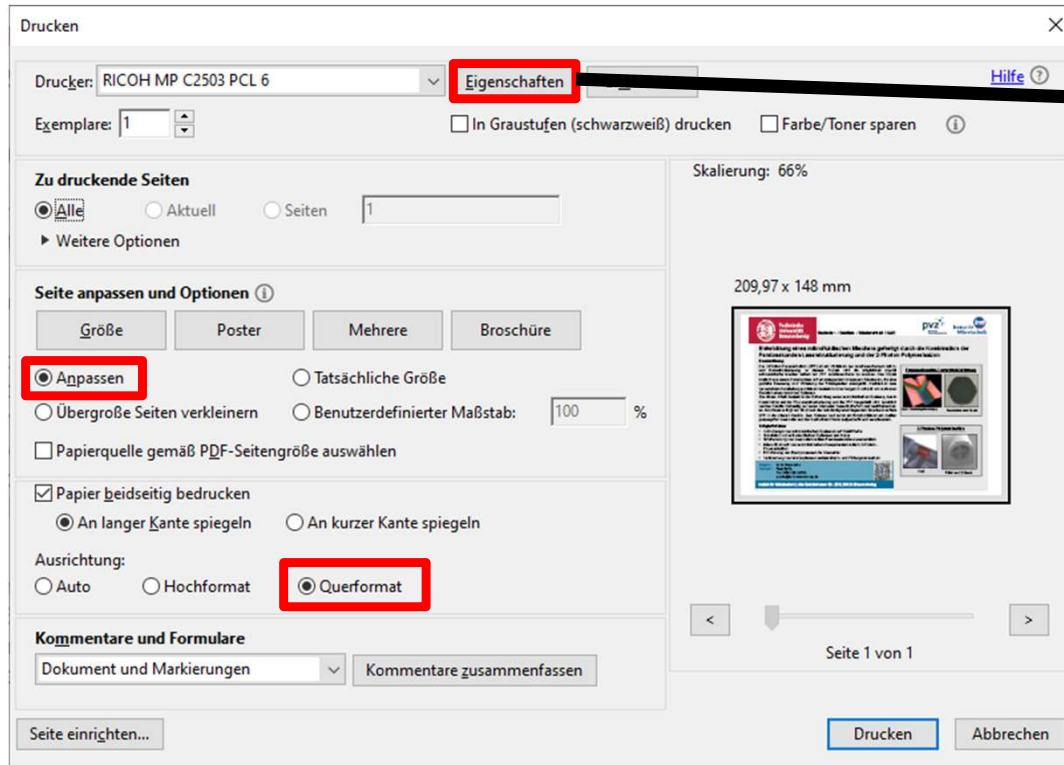
Hohe Qualität



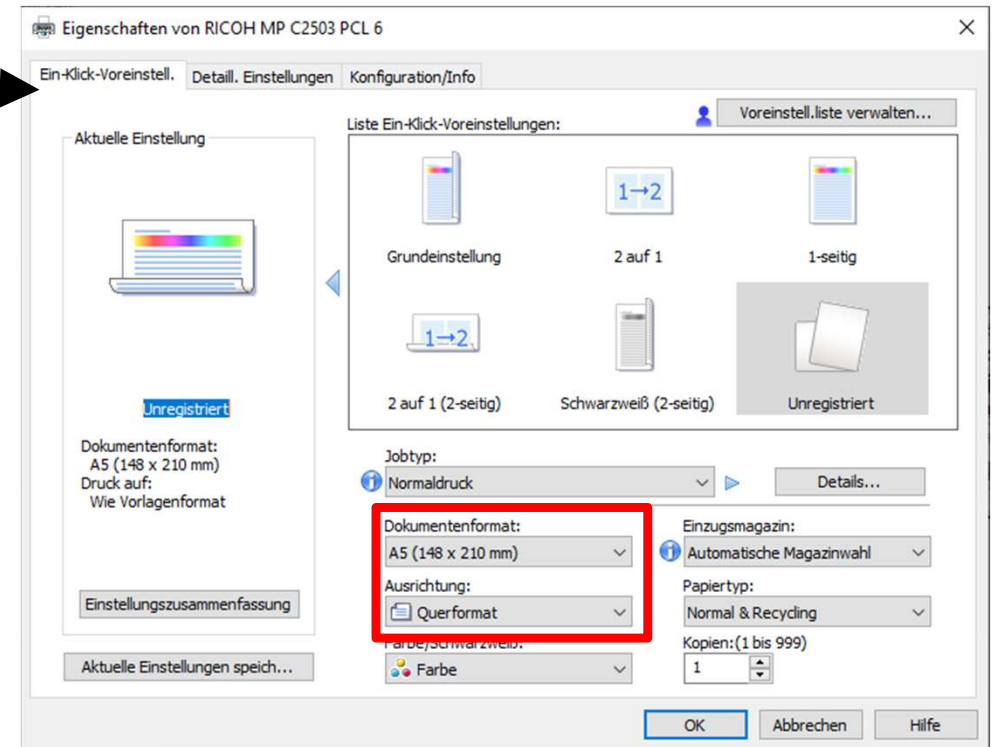
Printing of the student call for thesis

Print from pdf

Adjust slide on page and set to landscape format



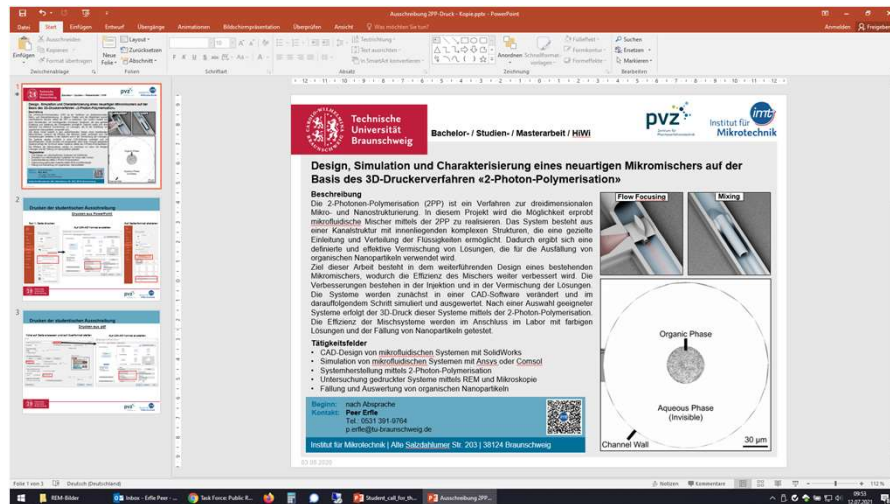
Set to DIN-A5 format



Convert the student call for thesis into a video

- For the conversion you only need Windows 10, which means you don't need to install any other programs.
- **Important!!!:** Your screen must have an aspect ratio of 16:9 or wider (e.g. 21:9). 4:3 or 16:10 is not allowed. The vertical resolution must be 1080.

1.) Finish slide for students



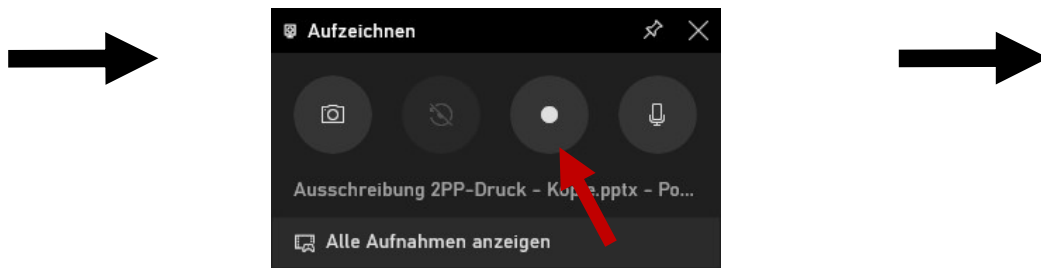
- ## 2.) Set the slide to full screen mode (Shift + F5). (If multiple screens are used, click with the mouse in the screen that should be recorded.)



Convert the student call for thesis into a video

3.) Open Xbox Game Bar with "Win key + G" and start recording the screen. (automatically included in Windows 10)

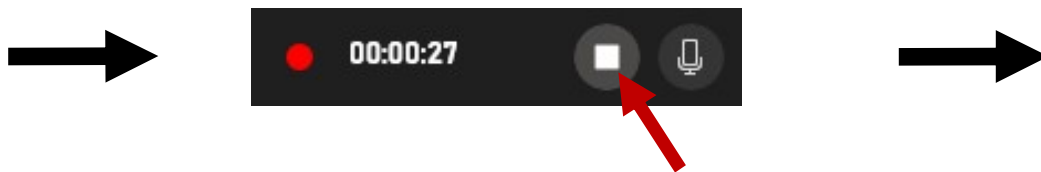
Alternative: "Win key + Alt + R" starts recording immediately



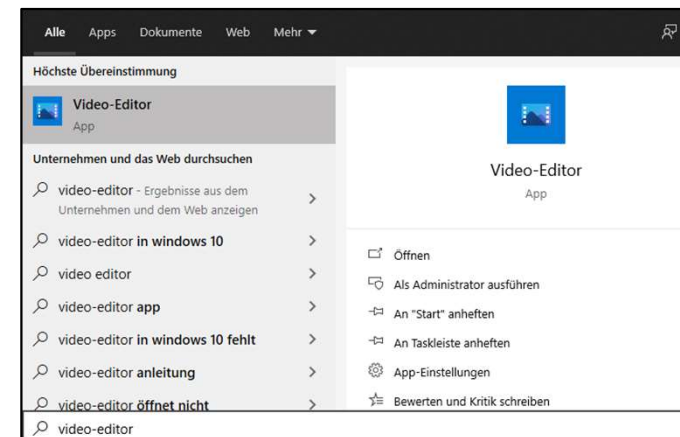
4.) Start animation in slide (move mouse pointer to the side!!!)



5.) Stop recording. The video is located in the "C:\Users\Username\Videos\Captures" folder.

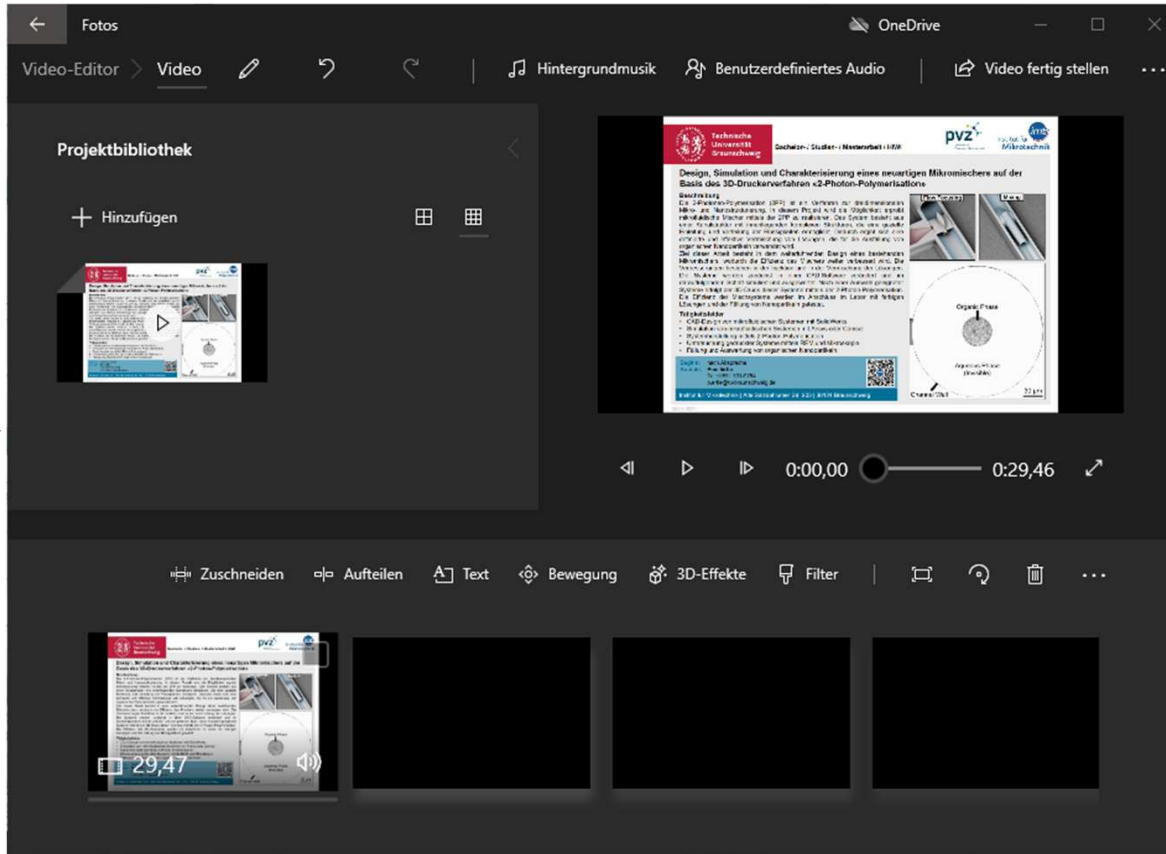


6.) Open the "Video-Editor" (automatically included in Windows 10)



Convert the student call for thesis into a video

7.) Use the editor to trim the video so that it has a duration of 30 seconds.



1. Trim the video to correct the beginning (e.g. remove delay or remove visible mouse cursor).
2. Shorten the video to 30 seconds or extend the video by repeating it.
3. **30 seconds is necessary to make it long enough to be seen on the screen in the foyer!**