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Applying Co-Sputtering to Increase DDR During Deposition of Titanium Oxides and Silicon Oxides

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SVC, Santa Clara, April 25-30, 2015

Problems of vacuum coatings technology

- Quality
- Productivity
- Cost

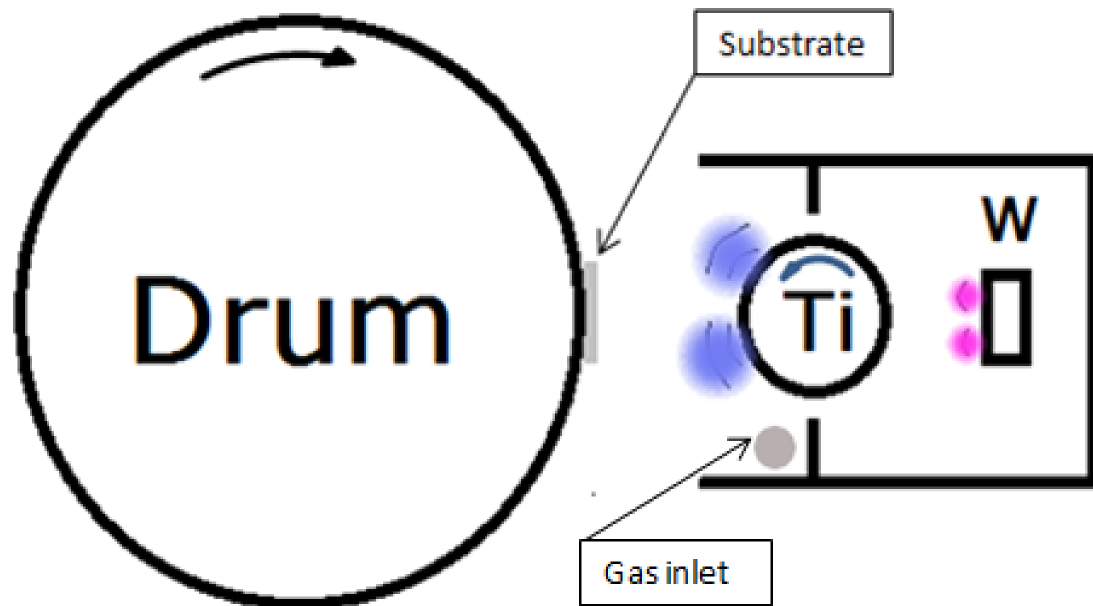
How reach increase of technology productivity?

- Increase in specific power of sputtering *(w/m)*.
- Work in a transition mode with control on a feedback.
- <u>Increase in sputtering factor by consecutive co-sputtering.</u>

Material	DDR, co-sputtering
Al_2O_3	+80%
TiO_2	+100%
C	+280%
SiO_2	??

Data from Fraunhofer institute publications

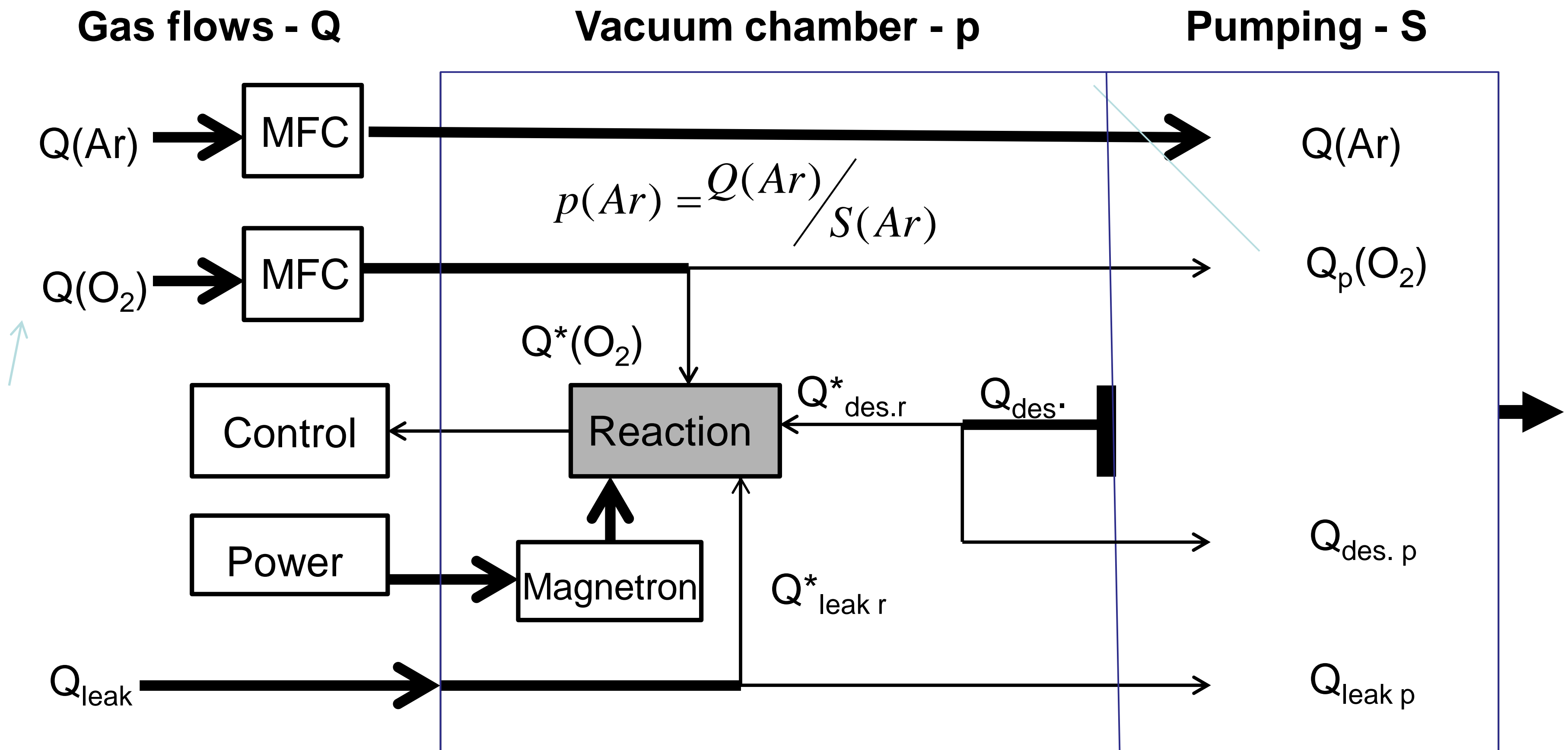
Serial co-sputtering diagram

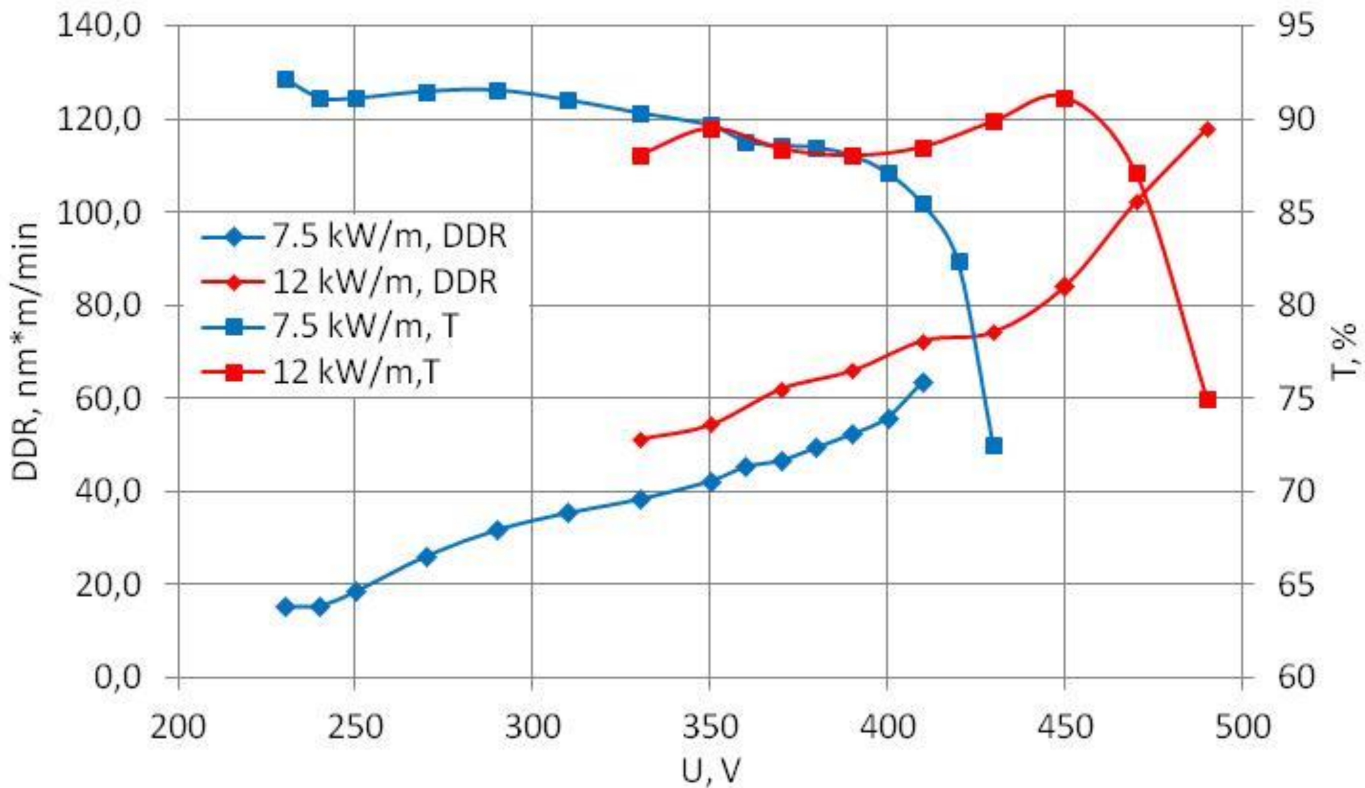


Parameters

- Main magnetron – Si or Ti
- Auxiliary magnetron – W
- Pressure – 5 mtor
- Distance target-drum – 100 mm
- Rotary magnetron length – 0.66 m
- Auxiliary magnetron length – 0.47 m
- Power supply – pulse DC
- Power (main) – up to 10 kW
- Power (aux) – 0-3 kW
- Substrate speed – 0.2 – 5 m/min

Reactive process scheme



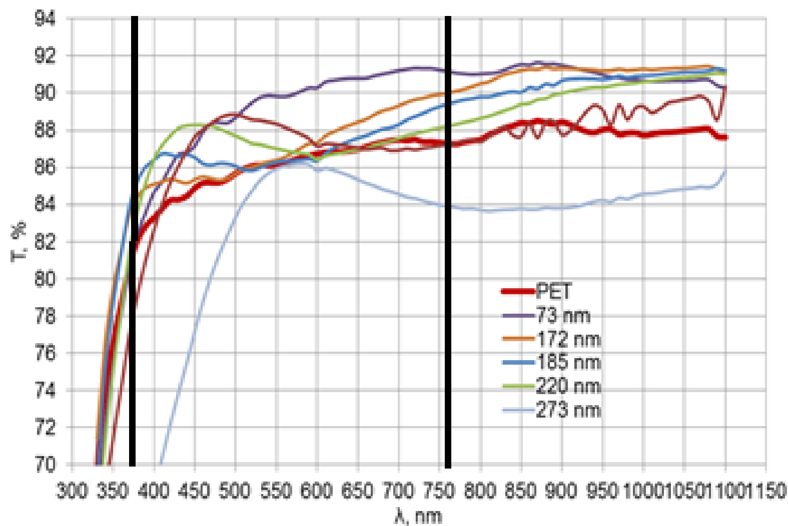


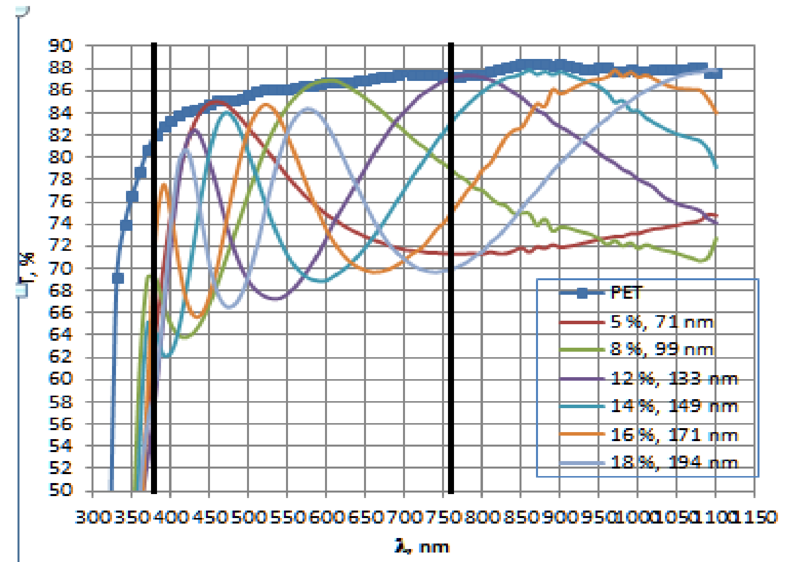
Comparison of process characteristics and properties of SiO_2 coatings at sputtering power of 7.5 kW/m and 12 kW/m (planar magnetron, pulse power supply).

SiO_2 and TiO_2 light transmission spectrums

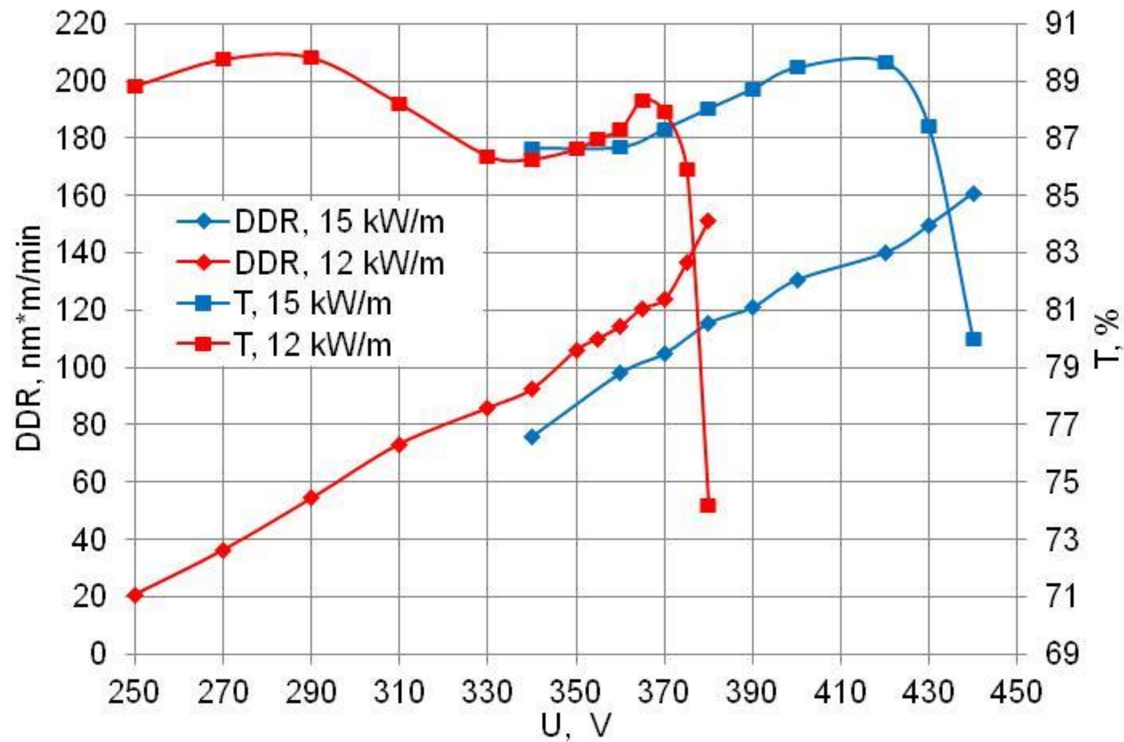
a) SiO_2, n_{sio2} = 1.48
n_{PET} = 1.65

b) TiO_2, n_{sio2} = 2.35
n_{PET} = 1.65

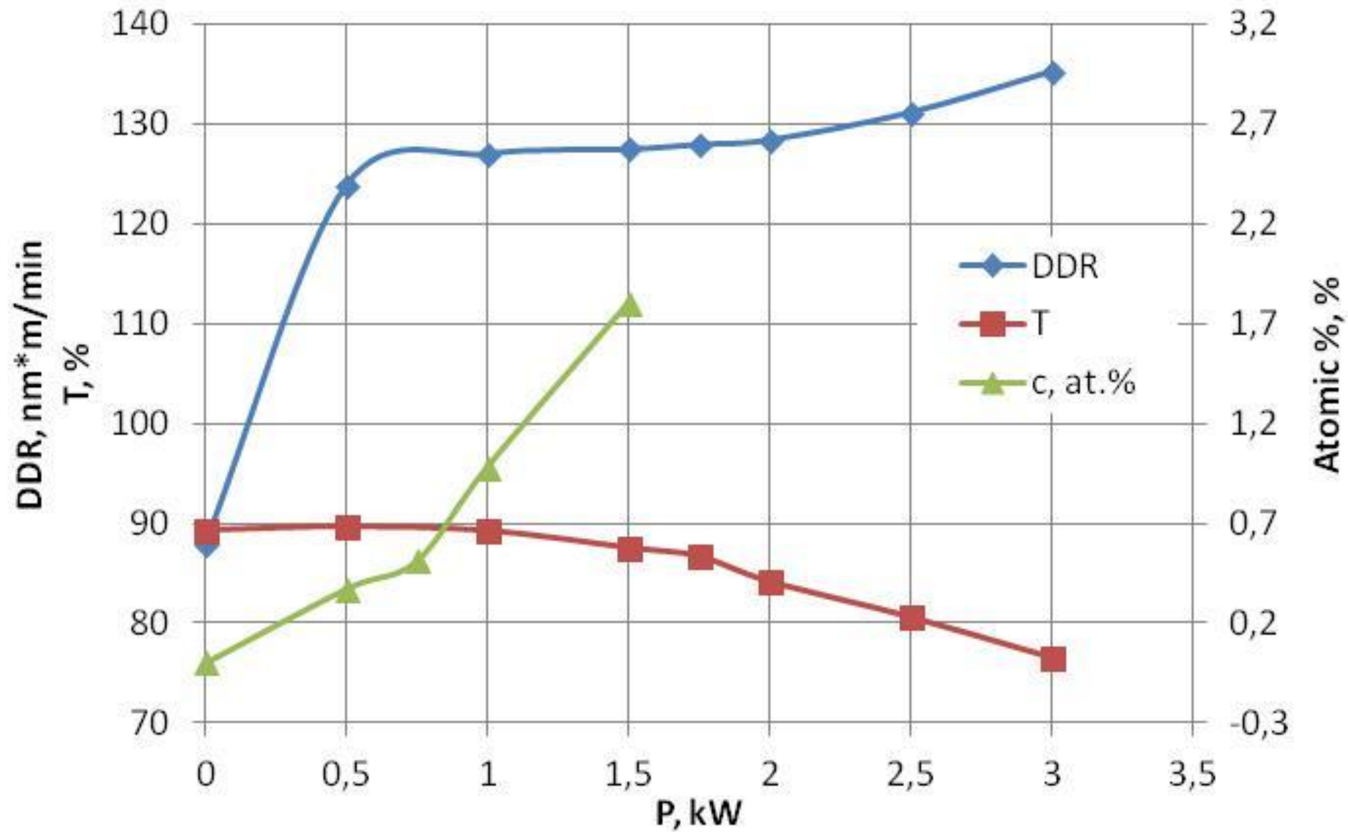




Transmission spectrum of silicon oxide (a) and titanium oxide (b) coatings of varying thickness produced applying serial co-sputtering



Comparison of process characteristics and properties of SiO_2 coatings at sputtering power of 12 kW/m and 15 kW/m in a serial co-sputtering process (pulse power supply.



Tungsten influence on properties of silicon oxide.

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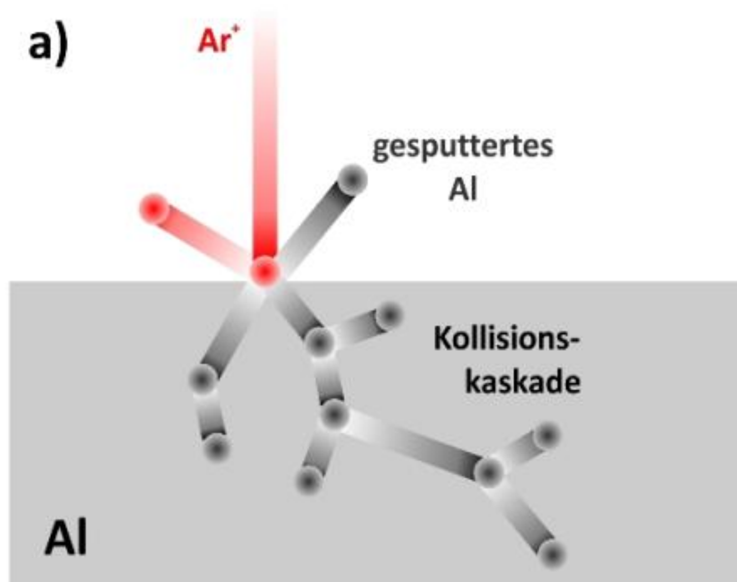
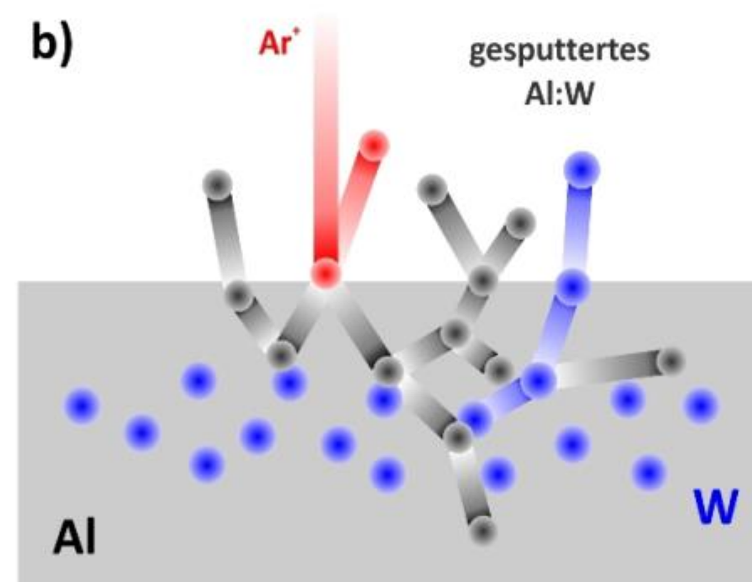
The scheme of reflection of cascades of collisions





Michael Austgen. Serielles Co-Sputtern. Düsseldorf, 2011.

Summary

- Specific power of sputtering, sputtering mode, sputtering factor - the major factors defining DDR.
- Co-sputtering of silicon and tungsten allowed effectively increase DDR for SiO_2 coating (+75%).
- In reactive processes it is recommended to use magnetron pulse power supplies.

Thanks for your attention.

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