Optical / SEM Investigations of YAG Screens

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Optical / SEM Investigation of YAG Screens
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HELMHOLTZ ASSOCIATION

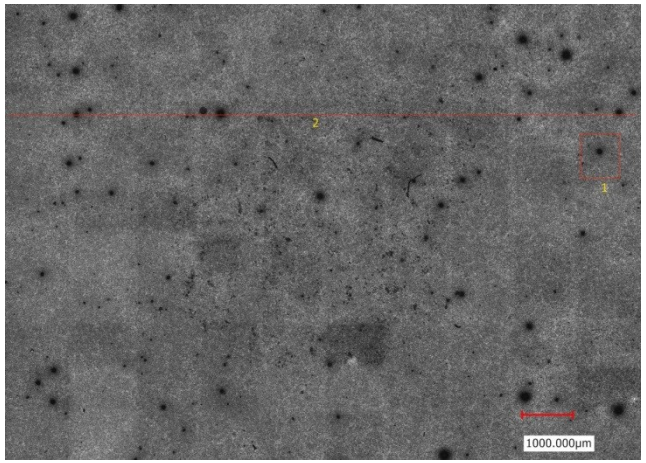
DESY

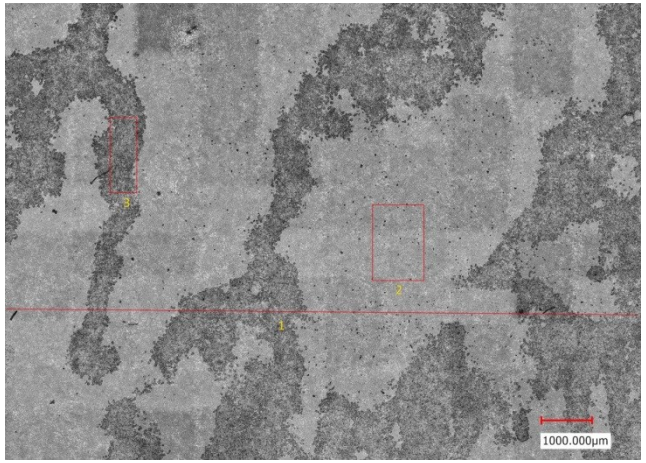
Motivation and description of characterized samples

- Worse electron beam images from “new” YAG screens
- Characterization of “old” and “new” YAG screens
- Optimization of production process

Recap

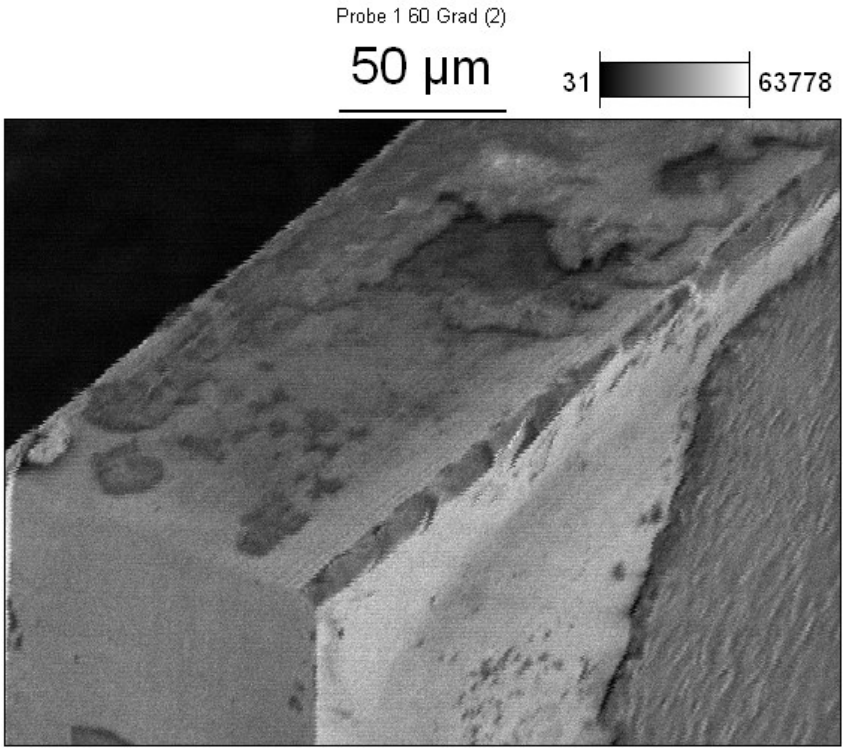
- Different disorders in surface profile:
  - Tears
  - Pores
  - General roughness
  - Small flawless areas





Scanning Electron Microscope (SEM)

- SEM located at TH Wildau (Fa. JEOL)
- Characterization of:
  - surface quality
  - film thickness
  - grain size

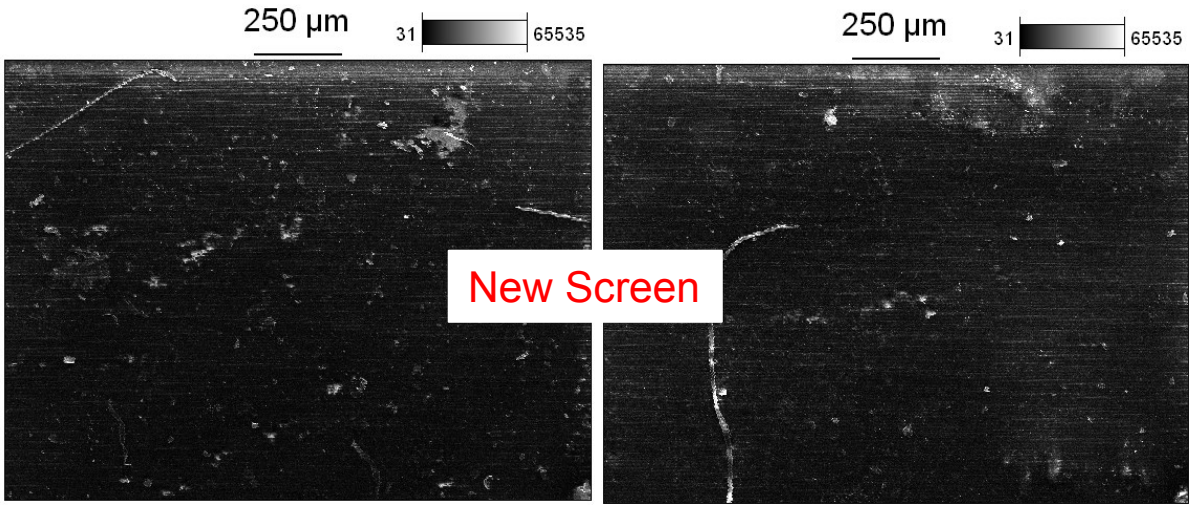


SEM image of YAG screen from newer series

Surface quality characterization (SEM)

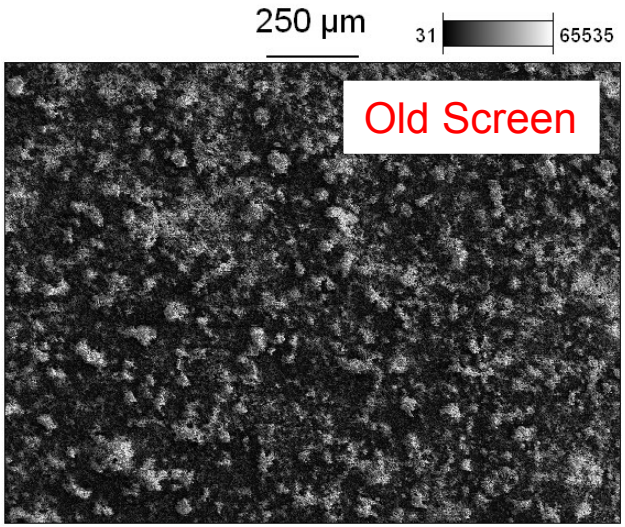
“New” screen:

- Relatively smooth surface
- **BUT** many dirt on and within the YAG surface (e.g. textile fibers)



“Old” screen:

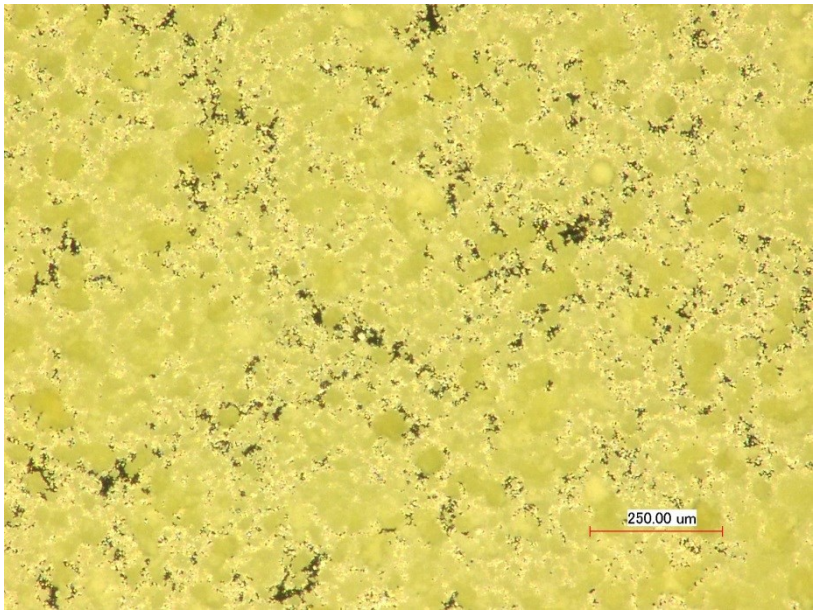
- Grain-like surface structure (size ~ 65.2µmx59.2µm)
- **NO** contaminations found



Surface quality characterization (optical microscope)

New Screen

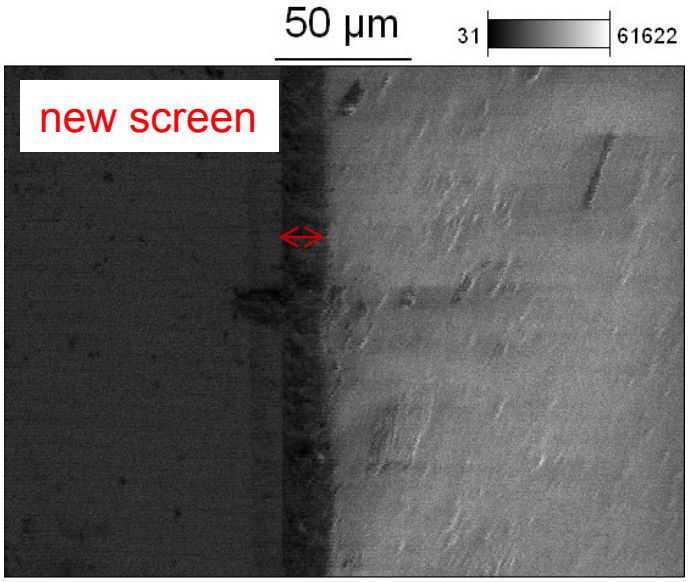
Old Screen

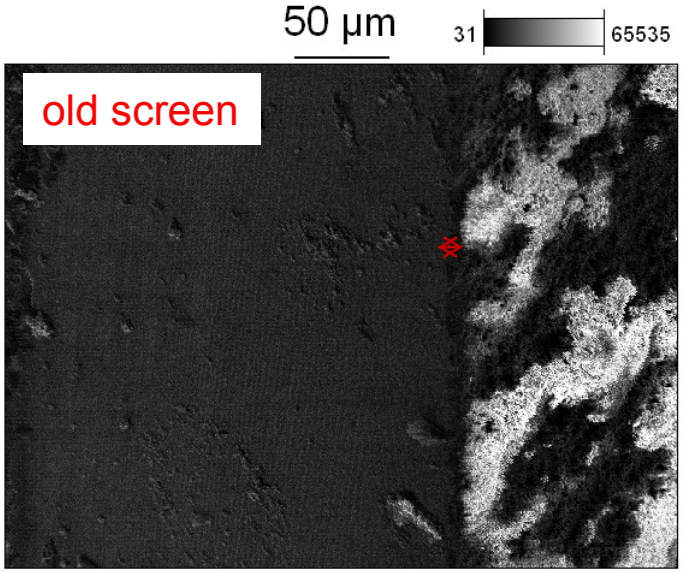


> Contaminations visible by optical microscope

Measurements of YAG layer thickness (SEM)

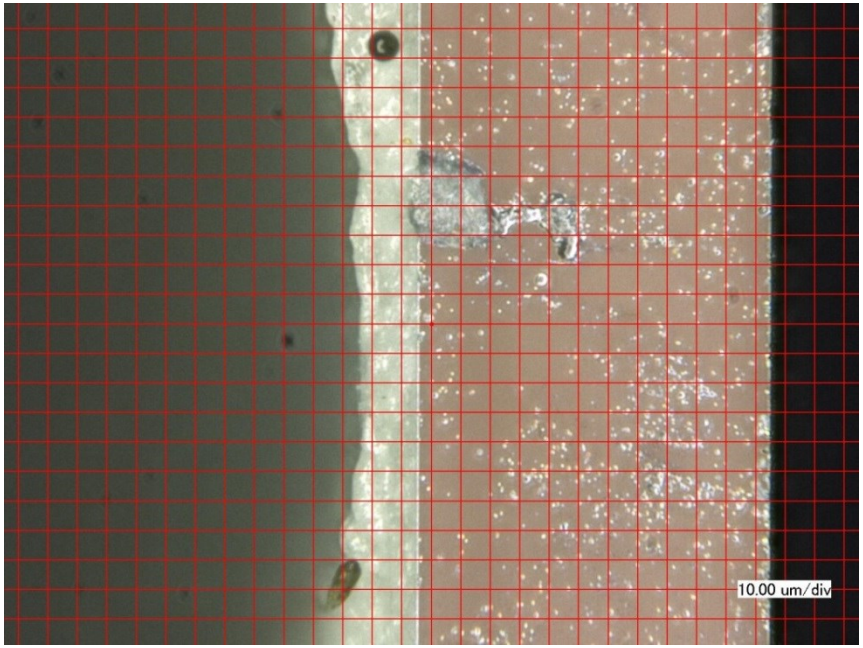
“new” screen [µm]	“old” screen [µm]
19.93	12.59
20.46	13.12
19.93	9.97
21.50	12.07
19.93	9.44
20.98	12.07
Avg. 20.46	Avg. 11.54





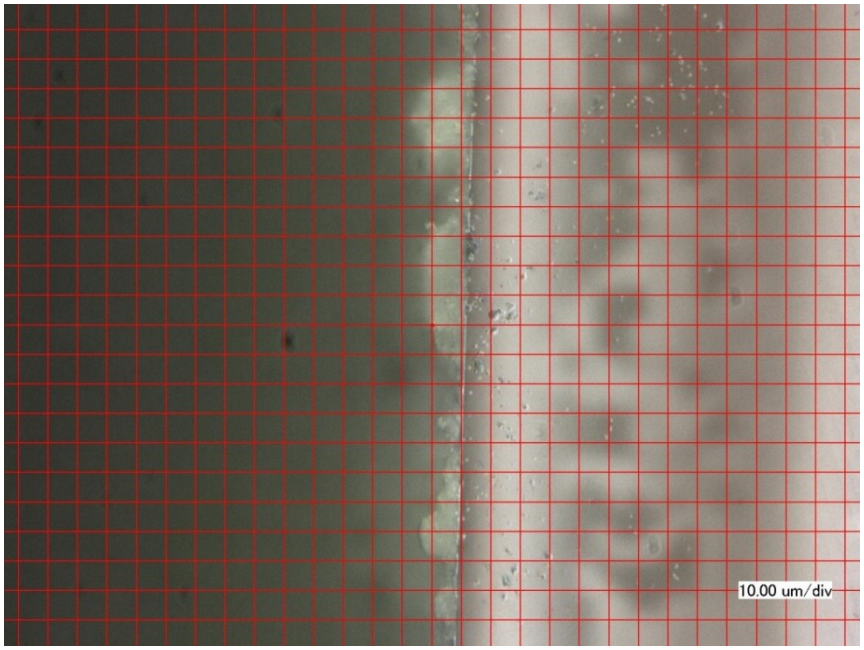
Film thickness Microscope

New Screen



19.28 µm

Old Screen



13.88 µm

> Confirmation of YAG layer thickness by optical microscope

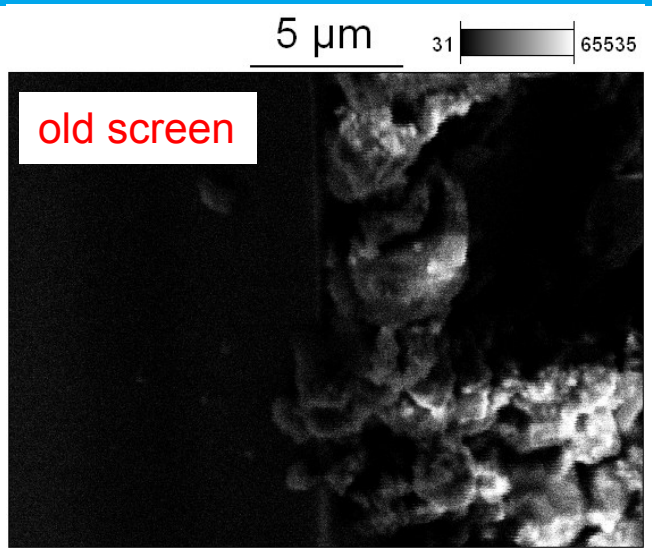
Grain size and film growth

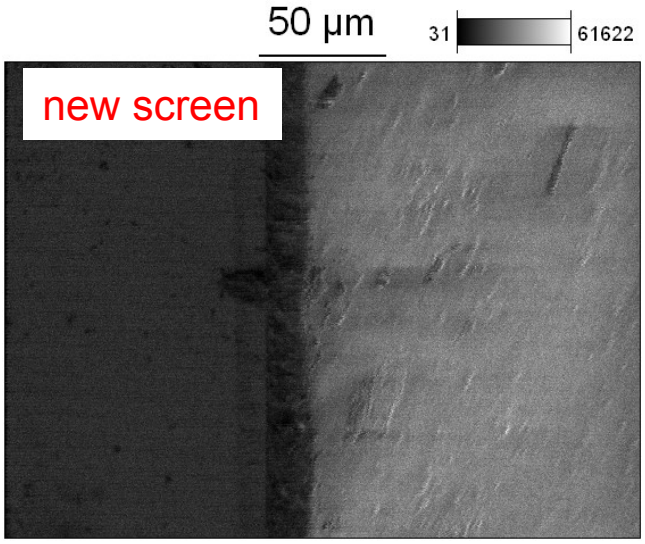
“old” screen:

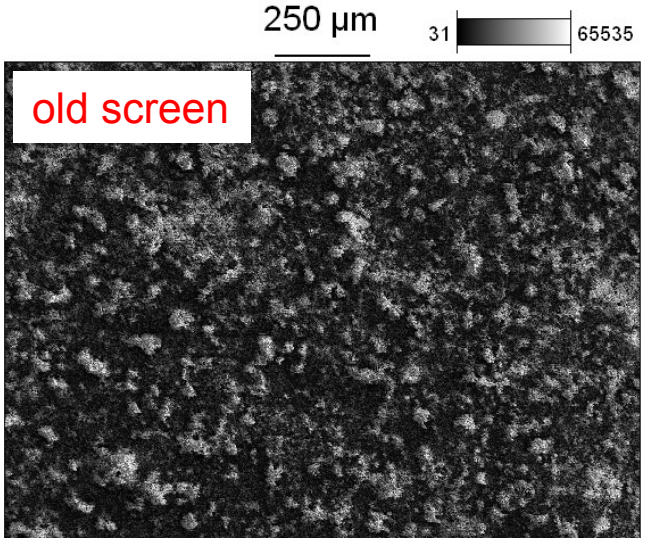
- Grain size: 2.4 µm x 2.16 µm
- inhomogeneous film growth

“new” screen:

- homogeneous film growth
- Almost no visible grains







Summary / conclusion

property	"old" screen	"new" screen
surface	no contamination	textile fibers
film thickness	11.54 µm	20.46 µm
grain size	~3 µm	not measurable

Significant differences in screen properties, e.g. surface structure and thickness

> Open Questions:

- Why do surfaces look different?
- Differences in production?
- Does he use different YAG-powder (grain size, …)?

> IMPORTANT → get in contact with Hamburg to clarify open questions!!!

Thanks for your attention

> Bonus content

Speculations

- **Grains**
- Looking from front perspective on the “new” screen → no grain structures visible
- Also you don’t see any disorders by observing it from the side perspective
- Maybe grain size was reduced or he grinds the grains further
- **Surface adhesion**
- In “new” screens, a polymer is used to adhere the grains on surface
- While “old’ screens doesn’t seem to have such a polymer

TDS SCREEN HOLGER

- error in TDS measurements
- H. Huck suspect error in YAG-screen or optics
- Optics checked no visible errors
- Problem: screen shattered
- Surface scan of shards