Optimisation strategy for aluminium optics using the meltspinning technology

By:
Albert Bosch, Roger Senden
RSP-Technology

Guido Gubbels, Bart van
Venrooy
TNO Science and Industry

Rochester, USA on 12 May 2009
Publication and presentation at SPIE conference ‘OPTIFAB’
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Production process

- Melting & alloying
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- Chopping
- 8 inch billet compaction
Advantage of meltspun aluminium for optical application

AA-6061

RSA-6061
RSA alloys for optics

Technical challenges:

- **In general:**
  - Develop a cutting edge quality level in terms of porosities and inclusions

- **Mirrors:**
  - Match fine microstructure with increased optical performance
  - Develop large dimensions up to 1 mtr

- **Moulds:**
  - Realise high quality optical mould surface without the use of a Ni-coating
  - Increase mechanical properties at elevated temperatures
## Materials

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Materials

RSA-6061

AA6061
Materials

RSA-6061

AA6061

Ra = 2.1 nm

Ra = 2.7 nm
Materials

RSA-6061

RSA-601
Materials

RSA-6061
Ra = 2.1 nm

RSA-601
Ra = 2.4 nm
Materials

RSA-6061  

RSA-612
Materials

RSA-6061
Ra = 2.1 nm

RSA-612
Ra = 9.8 nm
Materials

RSA-6061

RSA-905 (ER 38)
Materials

RSA-6061
Ra = 2.1 nm

RSA-905 (ER 38)
Ra = 1.5 nm
Typical RMS values after diamond machining of various alloys

![RMS values graph](chart.png)
Application examples

- Moulding application
- Baffle vane
Moulding application

Source: Zeiss
Moulding application

• **Problem description:**
  – Conventional mould material: stainless steel & Ni-coating
  – Too long lead times (weeks – months)
  – Expensive due to many processing steps

• **Objectives:**
  – Evaluate RSA-905 as a moulding material
  – Realise short lead time by reducing production steps (days-weeks in stead of weeks-months)
  – Test in optical application: sunglasses
Mould after diamond turning process

Sunglass design

Source: Zeiss
• **Results:**
  
  - Diamond machining of RSA-905 is easy
  - Polished surface is good enough but less brilliance than Ni-coating
  - Significant reduction of lead time: ~60%
  - Significant reduction of mould cost: ~30%
  - Up till now >1,000 parts have been produced and still running
  - Moulded sunglasses are well within tolerances: optically as well as geometrically

*Source: Zeiss*
Baffle vane application

- PEP study (Prekwalificatie ESA Programma’s)
  - Participants: NIVR, Dutch Space and TNO
  - Fabrication 1 mm thick baffle vane (Ø300 mm)
Baffle vane

• Results:
  – Baffle vane of RSA6061-T6
  – Surface roughness 3-6 nm Rq
Conclusions

• RSP materials offer good machinability
• Best surface qualities in RSA-905 and RSA-6061
• Suitable for optical components, like
  – Moulds
  – Special optics
• Good competitor with Ni-plated applications
Acknowledgments

• Carl Zeiss
• NIVR