3D-Druck von transparenten Bauteilen zum Einsatz in (laser)optischen Strömungsmessungen

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Ausgangssituation

- (Laser)optische Messmethoden wie Particle Image Velocimetry (PIV) [1,2] und Laser Induced Fluorescence (LIF) [3] an HSNR und in Strömungsmesstechnik allgemein entologopich etabliert
- Transparente Bauteile ermöglichen optische Zugänglichkeit
- Verwendung von PMMA/Acrylglas als Konstruktionsmaterial. Kombination mit brechungsindex-angegasstem. Fluid -> zur Vermeidung störender Lichtstreuung notwendig



Abb. 1: Rohner aus PMMA, Labor TC, HSWIT

Motivation und Zielsetzung

- Komplexe Geometrien wie Rührer (siehe Abb. 1) bisher nur eingeschränkt realisierbar -- Limitierung auf bestimmte Formen, optische Störungen durch Klebnähte, begrenzte Stabilität
- Neuer Ansatz: Einsatz der SLA-3D-Druck-Technologie zur Konstruktion transparenter Bauteile mit komplexen Geometrien aus
- Vorversuche zur Lackierung der Oberfläche sehr vielversprechend. (s. Abb. 2)



Abla, 2: 30-pedruckte Rührer, Latior T.C., MSN/R

3D-Druck

Ergebnisse und

- Einsatz der Stereolithographie (SLA) mit Form 3-Drucker und Material Clear Resin, Fa. Formlabs (4)
- Konstruktion von Modellen mit GAD-Software Autodesk Fusion 360 (vgl. [5])
- Anschließende Behandlung der Oberfläche durch Schleifen, Polieren und Lackieren

Einsatz verschiedener Applikationsverfahren

 Tauchwerfahren Pinselapplikation Sprühverfahren.

Bestimmung des optischen Brechungsindex

- Ablenkung eines Lichtstrahls an behandelter Oberfläche eines guaderförmigen. Testkörpers

n_o = sin o / sin ß

Abb. 3: Aufbau zur Bestimmung des Brechungsindes von Festkörpern, abgelenkter Lichtstrahl durch eingezeichnete Linie gekennzeichnet, Labor Physik, IntSNR

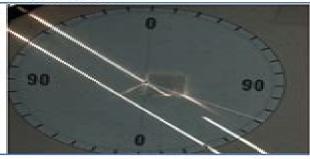


Abb. 4: Zylindroche Strombrecher nach Schliefen - Polieren direkti. lackbert mit Pinset (reichts)



Abb. 5: Propeller/Ores: unbetranciet (links), lackiert durch Eintauchen (rechts)

8. Stirting, n.J. Schultz, Flore Fields in Stirred Viscott Departing on Different Internal Inc.

Jahrtong, H.J. Schultz, Flore Freibt en Strong Steam Departing on Different Internet Insult Enthinger and Nessel Bottomes, Chem. Ing. Nucl. 81, 1262 St 1283–1293. https://doi.org/10.1003/cm.2012600.00.
 Millindis, M. Officiale, H.J. Schultz, Optical Measurement Method of Particle Suspension in Stored

Wrosels, Chem. Ing. Tech. 93 (2019) 1379-1359. https://doi.org/10.1002/che.201800099. A. Mefan, H.J. Schultz, Use of OpenFORM* for the Investigation of Mising Time in Agituted Inscells in

Erkenntnisse

- Ursache der Nicht-Transparenz gedruckter Objekte liegt. ausschließlich an der Oberfläche, während das Innere der Körper einheitlich und lichtdurchlässig ist
- Oberflächenbehandlung durch Schleifen, Polieren und Lackieren mittels Tauchverfahren (Klarlack aus Drogerie oder Baumarkt)
- Pinselapplikation (unebene Oberfläche) bedarf weiterer Untersuchung / Optimierung, Sprühverfahren (Bläschenbildung) nicht empfehlenswert
- Brechungsindex gedruckter Obiekte konnte bestimmt werden:

 $m_{\rm co} = 1.521$

Ausblick

- Finden eines geeigneten brechungsindex-angepassten Fluides.
- -- Einsatz in Messungen

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Strömungsfeldern in matriotofigen Rötmisstoven mithilfe einer Plusinissen Tracer Methoda, Chim. Ing. Texas, 82 (2020) 1305-1306, helps://doi.org/10.1000/see.202001079.

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