UNIVERSITÄT LEIPZIG

Medizinische Fakultät

Application of macro photography for the characterization of dental materials

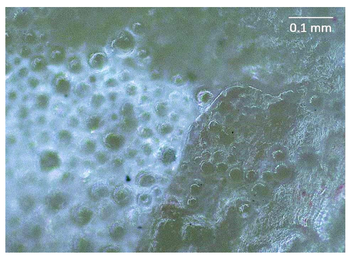
F. Fuchs, S. Hahnel, A. Koenig

Department of Prosthetic Dentistry and Dental Material Science, Leipzig University

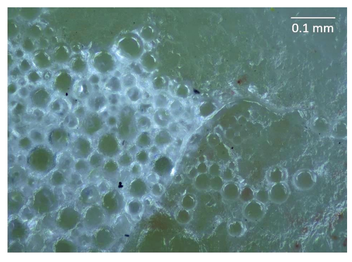
Macrophotography with automatic stacking is a novel, cost-effective and powerful approach to two- and three-dimensional (2D/3D) visualisation and analysis of curved dental material samples with uneven topography. The simple setup is modularly expandable and can be supplemented with state-of-the-art technology.

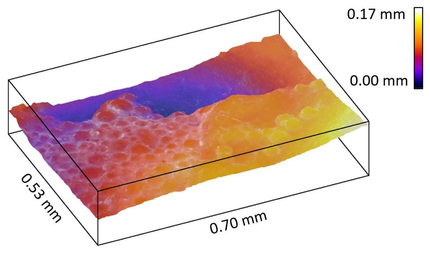
In order to evaluate the effectiveness of this method, a range of samples was photographed using various lenses, different light sources and an automatic stacking unit. The results were high-resolution images with an exceptionally high depth of field, permitting 2D sample imaging or 3D topographical determinations. A small (high f-stop) aperture was used to achieve a great focal depth (2.24 mm) and sharpness across the whole sample within a single picture. Using focus variation (automatic stacking) with a high magnification and large (low f-stop) apertures, the three-dimensional surface of the specimen could be analysed with a height resolution of 48 µm at 5x magnification. Furthermore, digital colour and translucency measurements could be reproducibly analysed by utilising standard illuminations. The use of an ultraviolet (UV) lamp makes partial material differentiation and fluorescence measurement possible. The images were analysed with the software “Helicon Focus 7.5.4” (Helicon Soft Ltd.) and “ImageJ 1.47v” (National Institutes of Health).

REGULAR MICROSCOPY

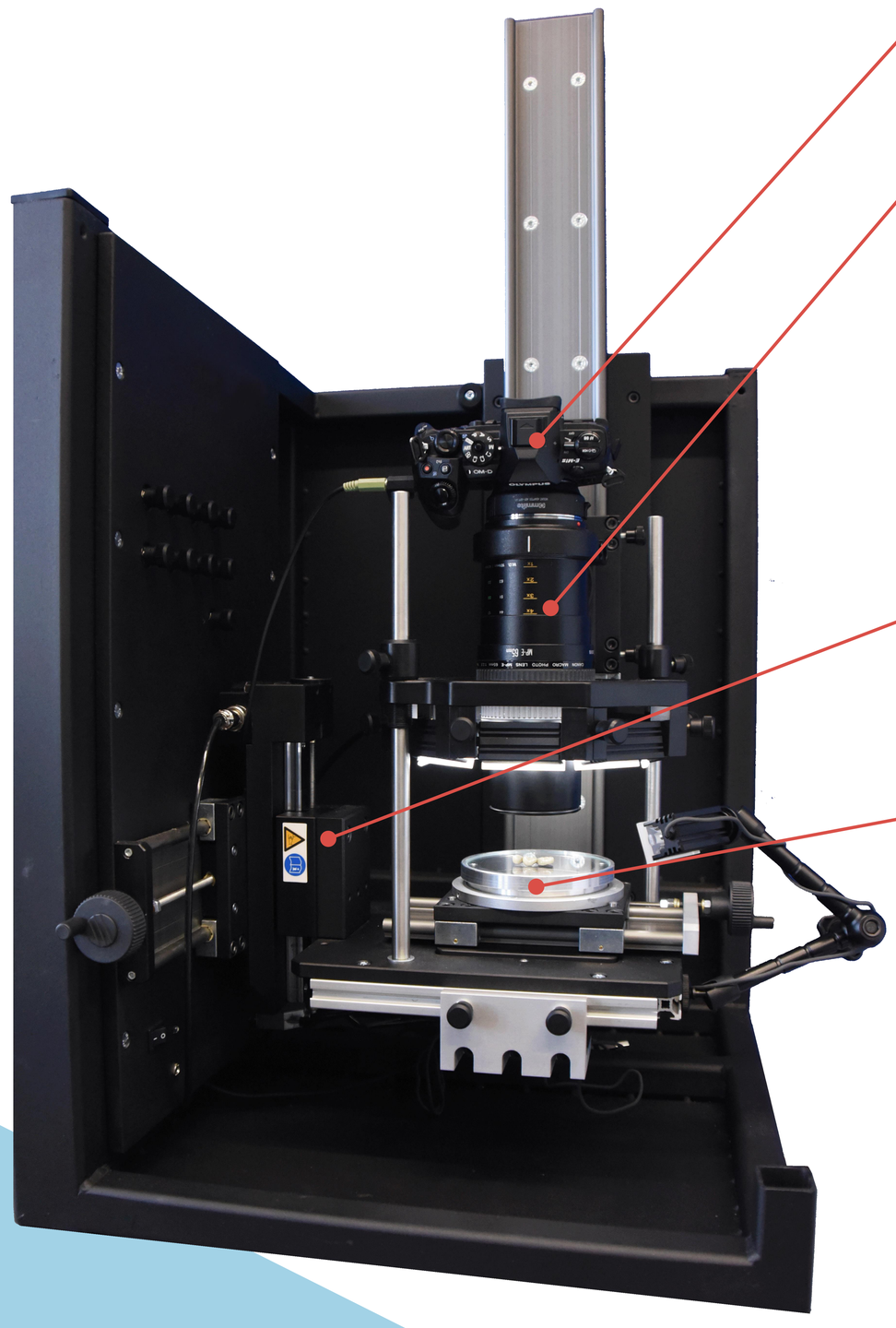


MACRO PHOTOGRAPHY





- ***Nearly unlimited focal depth***
- ***High resolution (50 MP)***
- ***Large field of view (1.6 mm x 1,2 mm)***
- ***Up to 120 mm sample height***
- ***3D imaging***
- ***Modular expandable (e.g.)***
- ***Equipment costs < 10,000 €***



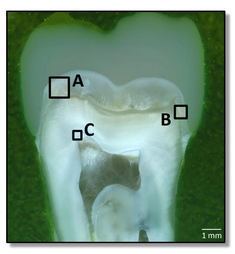
CAMERA

Olympus OMD EM 1 MARK II - *Permitting up to 50 megapixel images*

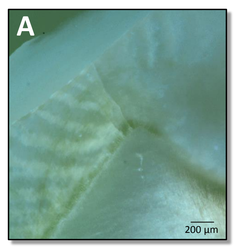
LENSES

CANON MP-E 65 mm f/2.8 1-5x

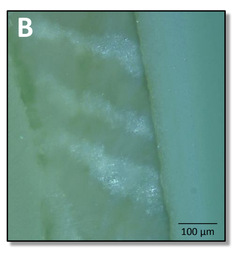
NIKON Plan 20x/10x



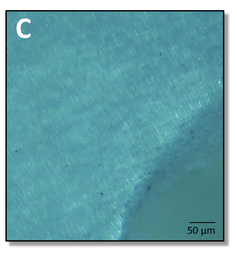
1:1



5:1



10:1

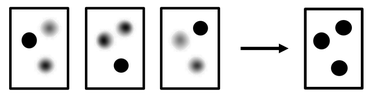


20:1

AUTOMATIC STACKING UNIT

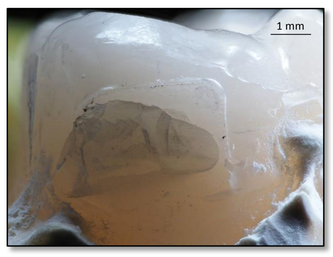
Stonemaster StackUnit

Automatic recording of different focal depths



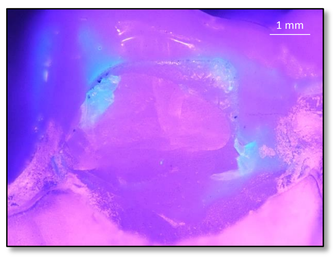
ROTATING X-Y TABLE WITH DIFFERENT LIGHT SOURCES

incident (D55)



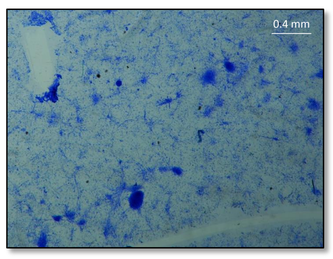
Fracture analysis
Color determination

ultraviolet



Material differentiation

transmitted



Cross section imaging
Crossed polarizers
Translucency measurement

COMPUTER HARDWARE & SOFTWARE

- Intel® Core™ i7-8700 CPU 3.20 GHz, NVIDIA Quadro P1000, 32 GB RAM
- OLYMPUS Capture 2.0 (Olympus Corporation)
- ImageJ 1.47v (National Institutes of Health)
- Helicon Software 7.5.4 Pro (Helicon Soft Ltd.)

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“EDV-gestützte hochauflösende Makrofotografie im Bereich Forschung und Entwicklung von dentalen Werkstoffen”

CONTACT

M. Sc. Florian Fuchs

Department of Dental Prosthetics and Materials Science
Leipzig University

Liebigstraße 12, Haus 1, 04103 Leipzig

T: +49 341 97 21 303 | E: florian.fuchs@medizin.uni-leipzig.de