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JOINING POLYCARBONATE

— MANUFACTURING AND EVALUATION OF TRANSPARENT JOINTS USING AN INNOVATIVE OBJECTIVE TEST METHOD

1. introduction
2. methodology
 - 2.1 material
 - 2.2 joining process
 - 2.3 test methods
3. results
4. conclusion

characteristics

applications

problem

solution

Unique applications in the polycarbonate value chain

figures 2010

problem:

- large - scale laminated safety glass
- dimensional limitation of the extrusion process

research aim:

- joining PC sheets
- good optical and mechanical properties
- restoring the transparency
- „invisible“ connections
- finding a suitable test method

material

- basic material tests (K.-F.-Titration, DSC, tensile-/bending test)

welding process

- variation of heating time

test

- mechanical and optical testing

results

- mechanical results
- optical results

radiator
distance

joining
pressure

radiation
power

drying time
80°C

heating
time [s]

2 mm
4 mm
12 mm } 30 – 60 s

base material

welding
process

test

results

- removing the specimen out of the center of the welded plates
- removal of the welding seam
- forming a flat and even surface
- stick the specimens to a cylindrical sample holder
- grinding and polishing in several steps
- repeat on other side
- finishing surface using a diamond suspension

photography

photoelasticity using a polariscope

microscopy

[10] Sony

[11] Olympus

base material

welding
process

test

results

1. laser
2. specimen
3. sample holder
4. micrometer
5. aperture
6. photoelectric cell

- new innovative test method
- enables qualitative and objective evaluation
- comparability of all samples
- detection of defects, joining dimensions and structural changes

base material

welding
process

test

results

- interpretation of the results from the light intensity measurement
- reference (air) = $150,986 \Omega \triangleq 0,0331 \text{ A}$

results light intensity measurement PC 2mm

$$\overline{A_1 A_2} \triangleq t_h = 50 s \triangleq 5,1 \text{ mm}$$

$$\overline{A_1 A_2} \triangleq t_h = 55 s \triangleq 6,4 \text{ mm}$$

base material

welding
process

test

results

- mechanical results comparable to the basic material strength
- the higher the tested heating times, the better the results
- restoring the initial transparency is possible
- production of transparent connections is possible
- evaluating the transparency using a new and innovative test method
- correlation between the test methods

base material

welding
process

test

results

conclusion

- validation of the new test method
- further parameter studies
- concepts for more efficient surface finishing

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[8]	Dietz, R. Aufbau der Infrarotschweißanlage, TU Chemnitz, 2016
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[10]	http://www.chip.de/artikel/Sony-a77_II-Alpha-77-II-DSLR-Test_70313035.html
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Thank you for your attention

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