

RepliSet



**An advanced
replica technique
for the inspection of
critical surfaces**



The most versatile replicating system

**For non-destructive testing and field applications
For engineering inspection and forensic investigation**

Replicate in the field – examine in the laboratory

- High resolution: down to 0.1 micron
- Virtually no shrinkage: dimensionally accurate for measurement purposes
- Optimized for either optical microscopy or comparator macroscopy
- Other inspection techniques include SEM, laser metrology and interferometry
- Extensive operator experience is not necessary
- Replicas of any size and shape can be produced
- Flexible high strength replicas can be taken from inaccessible surfaces and can be removed from moderately re-entrant geometry
- Short curing time
- Can replicate surfaces over a wide range of temperature

Medium C-steel. Sample etched with Nital 3%. Magnification x100

Sample



Replica



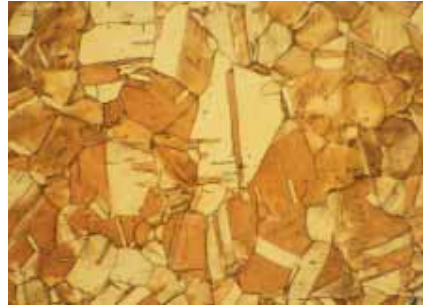
RepliSet is a complete system for replicating materials. It is designed to transfer the structure of a solid surface to a flexible, highly accurate and stable replica. The result is an exact 3D copy of the surface, allowing microscopic examination and precise measurements.

RepliSet is an accepted replicating system for ASTM standard E 1351 "Standard Practice for Production and Evaluation of Field Metallographic Replicas".

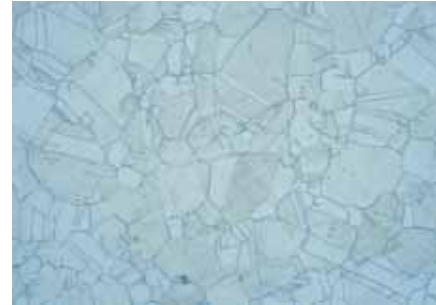
RepliSet is a specially formulated, fast curing, two-part silicone rubber. The compounds are supplied in cartridges and are applied using dispensing guns. The cartridges contain both polymer and curing agent, which are automatically mixed in a disposable static-mixing nozzle during application to the surface. Various, reusable nozzle tips are available for spreading the compound on a flat surface or for conducting the compound into holes and cavities.

A specially-designed backing paper, which bonds to the replica, is optional but it facilitates the handling, label-

Pure copper. Sample etched with cupric chloride and ammonia. Magnification x100



Sample



Replica

ing and protection of the replica. The backing paper also allows thin replicas of curved surfaces to be taped flat on glass slides for microscopic examination.

Replicating has never been so easy

With the easy-to-operate dispensing gun, everybody can produce perfect replicas first time. Extensive operator experience is unnecessary and you can be sure to return to the lab with good replicas.

In routine inspection situations, replicas produced by a person present in the field can be evaluated at specialist laboratories.

With the best possible success rate, RepliSet saves you time and consumables.

Any type and any shape

Most common solid materials such as metals, ceramics, plastics and glass can be replicated. It works even on rough re-entrant surfaces. There are no size or thickness limitations. The compound can be dispensed on any surface shape allowing inspection at remote locations where access is difficult, such as inside pipes or machinery. As the RepliSet replicas have a high tear



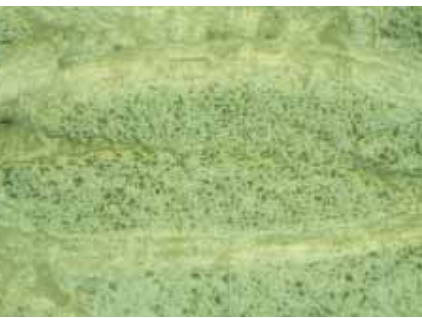
An operator dispenses RepliSet onto a sample



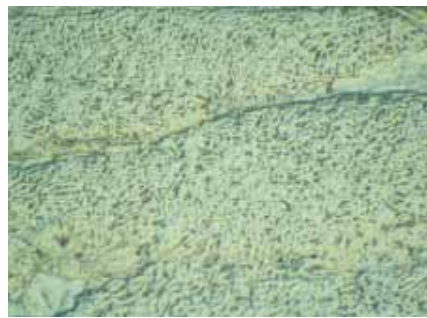
An operator peels off the cured replica



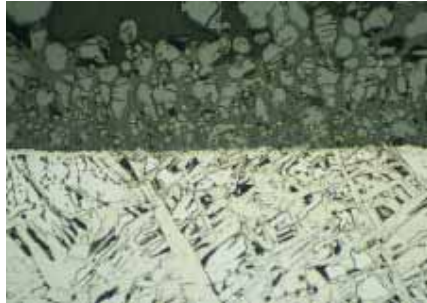
Sample



Replica



Kevlar fibre. RepliSet shows better image than original due to fibres' translucent behaviour. Magnification x 200



Sample using Bright Field



Replica using DIC

Overheated steel with corrosion layer. Etched with Nital 3%. Magnification x100



strength and flexibility they can easily be removed from moderately re-entrant geometry without damage or distortion. Upon release, the material returns to its original shape. A positive replica of a 3D surface can be produced by replicating the original replica with the compound itself or with an epoxy resin.

Under all conditions

The compound is available in versions with a range of viscosities and curing times tailored for application under different working conditions and on horizontal as well as vertical or overhead surfaces. Generally, the weather is no problem. Being water-repellent, RepliSet can provide replicas under humid conditions. It will cure on surfaces in a temperature range from -10°C to $+180^{\circ}\text{C}$ allowing rapid inspection and minimizing possible machinery downtime.

High resolution and form stability

RepliSet offers a very high resolution down to 0.1 micron. RepliSet has no shrinkage, and is therefore suitable for high accuracy metrology measurements. Replicas can be transported without any problems and can be stored indefinitely for future reference.

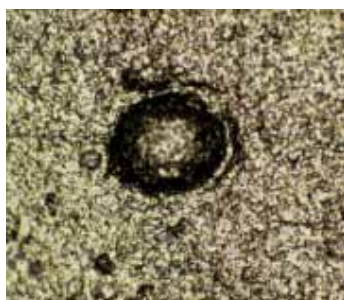
RepliSet is safe

RepliSet compounds are solvent-free and cleared for all normal modes of transportation, including air. During work the operator is not exposed to any unhealthy fumes.

The compounds are approved for use on stainless steel in nuclear plants. The materials are designed specifically to be compatible with stainless steels and other engineering alloys and not to compromise future corrosion behavior after replication.

Laser measurement of pitting

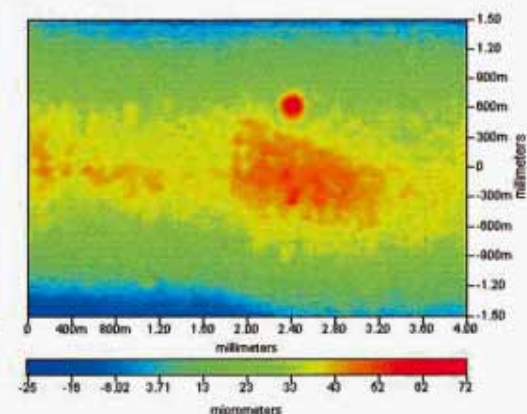
Replica of pitting

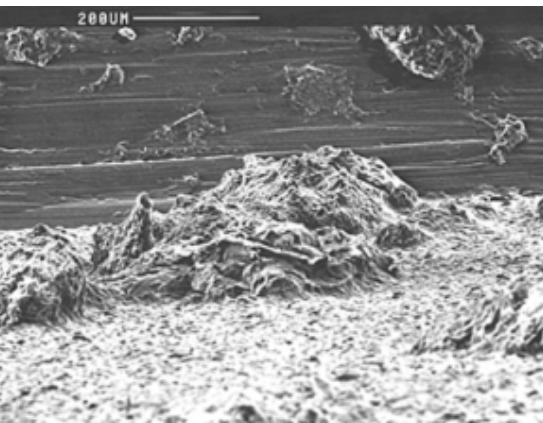


Depth of pitting

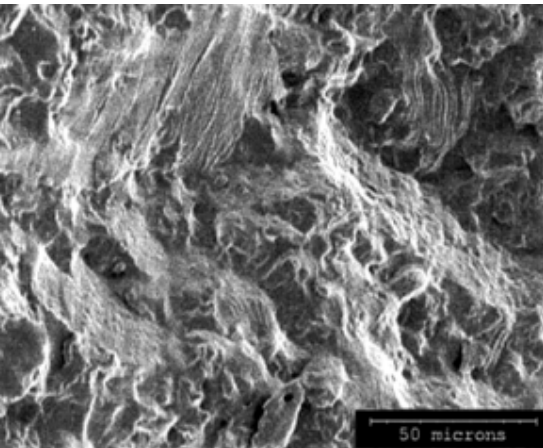


Width of pitting

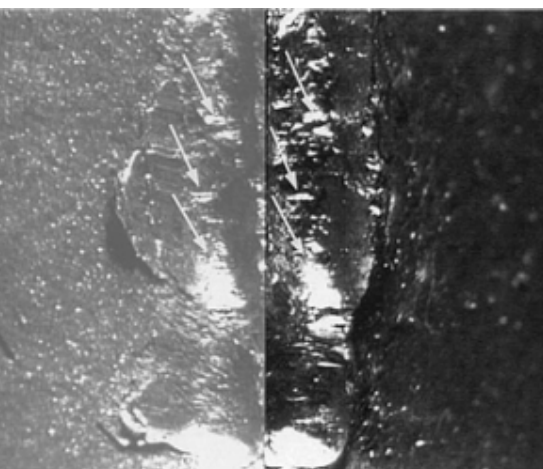




Replica of pitting. Examined by SEM



SEM micrograph of RepliSet replica of fatigue crack



The marks from previous use of the tool are identical



A variety of examination methods

The black coloured RepliSet-F and -T types are optimized for optical microscopy using reflected light. The replicas will reflect light like a metal. This makes them very well suited for micro-structural examination at magnifications up to x500 using Bright Field, Dark Field or DIC.

White light interferometry can be used for precise surface measurements including determination of surface finish.

Replicas can often give better results than the original surface, because of the uniformity of their reflection.

The grey coloured RepliSet-GF and -GT types have been formulated for macroscopy. The replica will give a high image contrast, when the surface is examined in a stereomicroscope with oblique illumination. This is particularly advantageous for monitoring of surface degradation, fracture surfaces, damage or wear. The products also have great potential for many metrology applications and for forensic examination of tool marks by comparator macroscopy. The grey types are not suitable for optical microscopy using reflected light.

All replicas are suitable for 3D examination at high magnifications by SEM either directly, using low values of column voltage, or after metallic coating.

3D examination can be carried out using non-contact metrology methods such as interferometry, laser scanning and shadowgraph projection.

Macrophoto of RepliSet-GF1 replica of cracking and pitting in heat affected zone in stainless steel



Engineering inspection applications

Typical applications are on-site non-destructive testing in connection with quality control, inspection, maintenance, reconditioning and failure analysis, typically within high tech engineering industries including power generation (fossil fuel or nuclear), aerospace, offshore industry, etc.

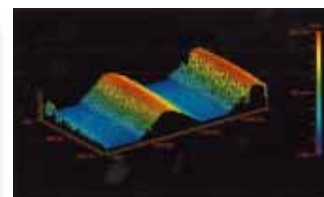
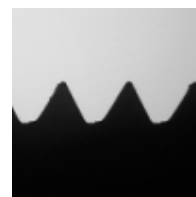
The use of high-resolution RepliSet replicas allows otherwise inaccessible surfaces and irregularities in critical machinery in service to be examined and measured under laboratory conditions.

Typical tasks are:

- detection and monitoring of pitting, corrosion, cracking, creep, deformation and wear
- assessment of change in micro-structure
- inspection of internal surfaces such as bolt hole threads and root welds in small bore tubes
- quality control of edges, heights, angles, surface finish, thread profiles and other dimensions

Forensic investigation

In the course of forensic investigations comparator macroscopy / microscopy is used to identify whether fine scratch details found in tool marks can be related to features on the original tool.



RepliSet-G is employed for replicating tool marks in the field. Comparison marks produced on lead using a suspect tool are similarly replicated and the replicas may be compared by comparator microscopy.

Case for RepliSet

The RepliSet Case is designed for transportation and use of the 50 ml RepliSet system. It is made of aluminium and is at the same time elegant and sturdy. It can be carried as hand luggage by air and is compact and sturdy to such an extent, that it can be taken to locations with narrow or difficult access.

The contents is either fixed by straps in the lid or placed in compartments in the two detachable foam rubber inserts. Each item has its fixed position. The user has access to all that is needed to perform a regular replication by just opening the lid of the RepliSet Case. The lower insert carries a small stock of consumables.

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The 50 ml system



The 265 ml system



Technical Data

Resolution of cured replica:	Down to 0.1 micron
Shrinkage:	Negligible
Tear strength:	15-20 kN/m ²
Temperature range for the surface to be examined:	-10°C to +180°C
Life span of the finished replicas is practically indefinite provided they are stored according to the instructions	
Content in static-mixing nozzle:	1.1 ml in nozzle for 50 ml cartridge 9.3 ml in nozzle for 265 ml cartridge

Specifications

RepliSet

Replication system for non-destructive testing of a microstructure or a 3D structure. Fast curing two-part silicon rubber compound for flexible high-resolution 3D replicas.
For the 50 ml system, the hand-operated dispensing gun (SEFUN) and the static-mixing nozzles (REPNO) are used in combination with the 50 ml cartridges (REPF5), (REPF1), (REPT3), (REPT1), (REGF1) or (REGT1).
For the 265 ml system, the hand-operated dispensing gun (RELUN) and the static-mixing nozzles (RELNO) are used in combination with the 265 ml cartridges (RELF5), (RELF1), (RELT3) or (RELT1).

RepliSet-F5

General purpose material. Particularly useful for replicating horizontal or sloping surfaces in normal or high temperature conditions. Fluid fast curing compound with working life of 5 min. and curing time of 18 min. at 25°C
50 ml cartridge size. Package of 5 cartridges
265 ml cartridge size. Package of 2 cartridges

REPF5
RELF5

RepliSet-F1

Particularly useful for replicating horizontal or sloping surfaces in low temperature conditions or where rapid results are required. Fluid rapid curing compound with working life of 0.5-1 min. and curing time of 4 min. at 25°C
50 ml cartridge size. Package of 5 cartridges
265 ml cartridge size. Package of 2 cartridges

REPF1
RELF1

RepliSet-T3

General purpose material. Particularly useful for replicating vertical or overhead surfaces in normal or high temperature conditions. Thixotropic fast curing compound with working life of 3 min. and curing time of 10 min. at 25°C
50 ml cartridge size. Package of 5 cartridges
265 ml cartridge size. Package of 2 cartridges

REPT3
RELT3

RepliSet-T1

Particularly useful for replicating vertical or overhead surfaces in low temperature conditions or where rapid results are required. Thixotropic rapid curing compound with working life of 0.5-1 min. and curing time of 4 min. at 25°C
50 ml cartridge size. Package of 5 cartridges
265 ml cartridge size. Package of 2 cartridges

REPT1
RELT1

RepliSet-GF1

Replication system especially for comparative microscopy and metrology. Particularly useful for replicating horizontal or sloping surfaces and filling holes. Fluid rapid curing compound with working life of 0.5 - 1 min. and curing time of 4 min. at 25°C.
50 ml cartridge size. Package of 5 cartridges

REGF1

RepliSet-GT1

Replication system especially for comparator microscopy and metrology. Particularly useful for replicating vertical or overhead surfaces. Thixotropic rapid curing compound with working life of 0.5 - 1 min. and curing time of 4 min. at 25°C.
50 ml cartridge size. Package of 5 cartridges

REGT1

Accessories

Hand-operated dispensing gun

For 50 ml cartridges of RepliSet replication compound
For 265 ml cartridges of RepliSet replication compound

SEFUN
RELUN

Static-mixing nozzles

For 50 ml cartridges. 35 pcs.
For 265 ml cartridges. 10 pcs.

REPNO
RELNO

Nozzle tips for replicating flat surfaces

To be mounted on static-mixing nozzle (REPNO). 10 mm with fish tail spreaders. 10 pcs.

REP10

Nozzle tips for replicating holes

To be mounted on static-mixing nozzle (REPNO).
For small holes. 1 mm diameter. 30 mm long. 10 pcs.
For large holes. 4 mm diameter. 100 mm long. 10 pcs.

REPON
REPIX

Backing paper

For RepliSet replication system. Bonds to the replica and facilitates labelling, handling and the levelling of replicas to assist microscopic examination. 60 x 70 mm. 100 pcs.
A4 (210 x 297 mm), for cutting up to the required size. 10 pcs.

REBAS
REBAL

Case

Aluminium carrying case for transporting the 50 ml RepliSet system. Foam rubber inserts have room for all necessities for field applications: 1 Dispensing gun, 5 new cartridges and 2 cartridges in use, 2 x 35 pcs. static-mixing nozzles, nozzle tips, backing paper, cleaning fluid and finished replicas

REPCA

Struers' products are subject to constant product development. Therefore, we reserve the right to introduce changes in our products without notice.



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