POLYURETHANE PARTS AND MATERIAL SPECIALISTS

SUNCAST POLYTECH INC.

INDEPENDENT ENGINEERING REPORT

TESTING THE RECAST™ BOND

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Introduction

SUNcast Polytech Inc. has developed a proprietary process technology called ReCast™ that makes it possible to rebuild or recycle worn polyurethane (PU) parts. The technology creates a completely secure bond between virgin and cured PU cast elastomer enabling ReCast™ parts to perform successfully in demanding environments, such as pipeline pigging.

Because cast elastomer PU is an expensive material and has not been recyclable, SUNcast's technology offers an opportunity for operators to reuse what is now waste.

The technology has been successfully used to rebuild wear parts for a variety of applications including pipeline pigs. ReCast™ parts have been manufactured with as much as 90% recycled material.

Testing Objective and Method

The purpose of the study was to determine ReCast™ bond performance levels.

ReCast™ test pieces were made by bonding virgin material to scrap PU substrate material. A variety of substrate parent materials were used so as to provide a broader picture of the technology's capabilities. Both ReCast™ and parent material control samples were tested and compared for ultimate tensile strength and percentage elongation at failure. The ReCast™ test pieces were made utilizing scrap material from four sources:

Parent Material Profile
A SOLID CAST PIPELINE PIG (ie. MaxiDisc design) which had already been rebuilt once using the ReCast™ technology. This tool had over 5,000 km of use in a crude pipeline and was made of Shore A80 material.
A discarded WIPER DISC taken from a steel mandrel type batching pig used in a crude pipeline. The disc's hardness was Shore A73.
A WIPER DISC similar to the above (ie. Shore A73), but in this case the new PU cast to the old material was harder – Shore A88. This was done to test the technology's effectiveness in making dual durometer parts.
Off-cuts from J HOOKS used in lumber and planer mill conveyor lines. This material had a hardness of Shore D75.

All scrap test material was cut into _" thick coupons, cleaned and then treated using SUNcast's proprietary surface treatment process. New PU material was cast onto the prepared parent material surface using SUNcast's proprietary ReCast™ process. The test coupons were trimmed and machined into a modified dogbone shape with the bond isolated in the middle of the gauge length. This testing geometry provided for a very severe test of the bond.

The test coupons were then loaded to failure in an INSTRON load frame. The crosshead speed was set at 500mm/min and data was recorded using Keiphley Data Acquisition hardware and Easyest LX software (Figure 1).

The failure surfaces were examined using a Carl Zeiss Jenapol optical microscope under low magnification. These surfaces were also examined using scanning electron microscopy (SEM – Joel JSM-5800) after gold sputter coating the surfaces.

Results and Discussion

The results of the tests are summarized below.

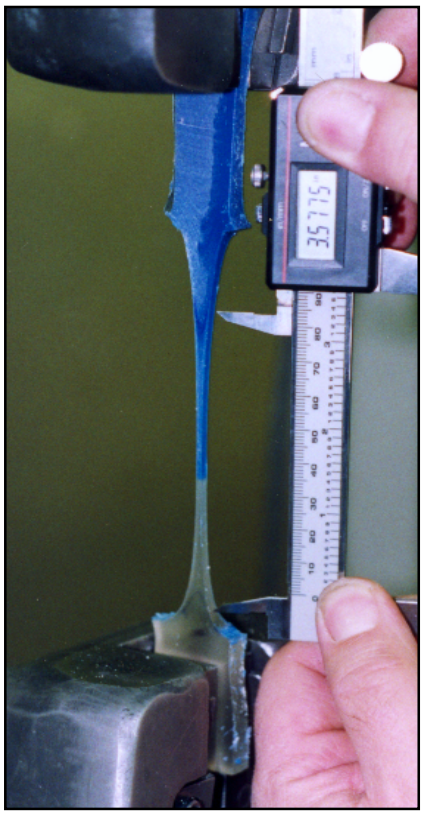

Figure 1 – ReCast™ sample at >500% elongation. The parent material is blue, the new material is amber.

SOLID CAST PIG – 2ND ReCast™	
Parent Durometer	Shore A80
Ultimate Tensile Strength (psi)	6,600
% Elongation	517
Performance Equivalent to Parent	YES
Locus of Failure	In both materials.

WIPER DISC – Dual Durometer ReCast™	
Durometer (Parent:Virgin material)	Shore A73:A88
Ultimate Tensile Strength (psi)	6,203
% Elongation	547
Performance Equivalent to Parent	YES
Locus of Failure	In parent material.

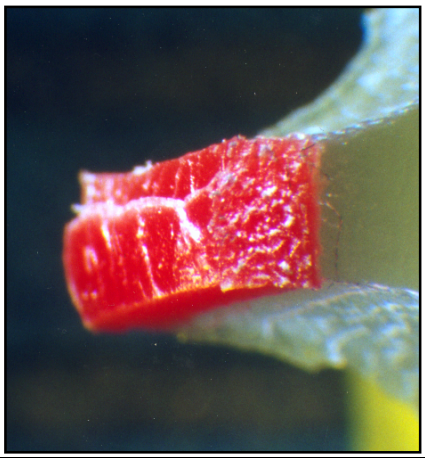

Fig.2 – Fracture in parent material

WIPER DISC ReCast™	
Parent Durometer	Shore A73
Ultimate Tensile Strength (psi)	4,711
% Elongation	582
Performance Equivalent to Parent	YES
Locus of Failure	In parent material.

J HOOK ReCast™	
Parent Durometer	Shore D75
Ultimate Tensile Strength (psi)	5,651
% Elongation	Not measured
Performance Equivalent to Parent	YES
Locus of Failure	In both materials.

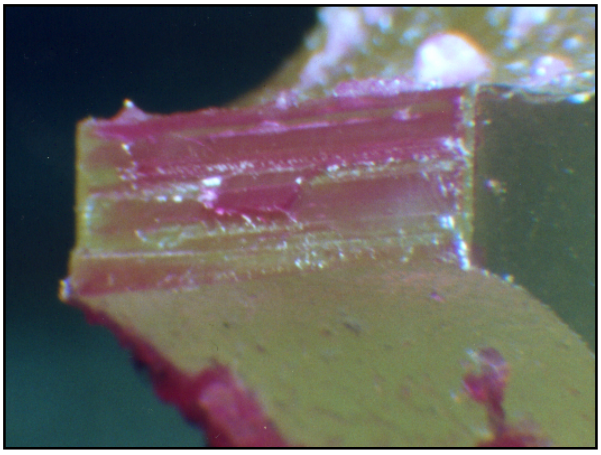

Fig. 3 – Fracture in both parent and new material.

There are a number of highlights from the test results:

ReCast™ samples achieved the same high levels of ultimate tensile strength and percentage elongation as original material.

There were zero bond line failures.

The ReCast™ process was successful in making dual durometer pieces.

These results are further reinforced by the photomicrographs (Figures 4 & 5 below) showing optical and scanning electron micrographs of the same sample. Figure 4 shows a typical fracture surface with the fracture occurring through both materials, the parent substrate (orange) and the new virgin material (amber). Of particular interest is the absence of an obvious bond line visible on the SEM photomicrograph in Figure 5. The bond line was not discernible even at very high magnification.

Fig. 4 – at 30x

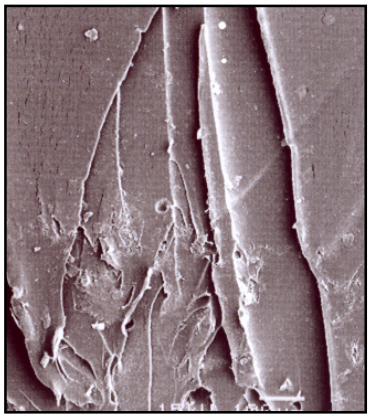

Fig. 5 – at 100x

ReCast™ technology is a powerful new way to manufacture high performance wear parts using previously unusable PU cast elastomer material.

REDUCE RECAST™ RECYCLE

SUNCAST

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