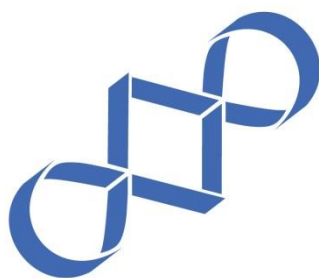


Tensile Strength Testing of Extruded Virgin PVC versus 100% PVC Regrind

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A series of pull tests were performed on two different compositions of PVC 000655. PVC re-grind and PVC virgin materials were extruded, cut into samples and pulled using the pull testing machine to establish the raw pull force and PSI associated with them both. There was a difference of 45 PSI between the averages of both test results with the virgin material snapping at 6411 PSI and the re-grind material snapping at 6365 PSI.

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Introduction

To compare the difference in physical characteristics between PVC re-grind and PVC virgin, the Omachron Generation 2 – Machine #2 extruder was used. The extruder had a 40:1 gearbox, and an extended screw (1/2" longer) to accommodate the extrusion dye. 8' lengths of rod were extruded from both materials (no water bath used) before being marked and cut into a series of 4" samples. Ten samples of each material were cut for the testing procedure with a couple spares also created in the event of error.

Procedure

To ensure the diameter of all the samples tested was consistent, each 4" sample was placed in the lathe and an 1/8" section of length from the middle of each one was turned down to 0.162" diameter. Every diameter of every sample was individually verified using a set of Mastercraft digital vernier calipers to confirm all diameters were to within 0.001" of the intended width. The two different sets of samples were colour coded to ensure that no samples could get confused with another, as both were relatively similar to the naked eye.

The band heater temperatures were kept the same for the extrusion of both materials. The temperatures, from thermocouple #1 (closest to the hopper), to thermocouple #5 (nozzle), were as follows; TC1 - 155°C, TC2 - 160°C, TC3 - 165°C, TC4 - 168°C, TC5 - 170°C. The thermocouple attached to the nozzle ring (heated by 4 cartridge heaters), was controlled by a variac and read a temperature of ≈180°C throughout.

The machine settings was run at 15RPM throughout the entire extrusion process of both materials.

The testing procedure involved using the Omachron pull testing machine. This machine has two clamps; an upper, and a lower. The 4" sample of PVC were placed into the bottom clamp. The upper clamp was then lowered and tightened to the top of the sample. It was ensured that the 1/8" section of sample at 0.162" diameter is located between the two clamps so as to be the point where the sample snaps. With the bottom clamp held in position, the upper clamp is brought up using the manual controls. With the upper clamp pulling, and the lower clamp holding, the sample eventually snaps due to the force exerted, and this force is converted to kg and displayed on the computer program that accompanies the pull testing machine.

Results

When extruding the PVC re-grind, an average of approximately 1100 PSI was observed throughout the test, falling to as low as 1000 PSI and as high as 1200 PSI. The average amps observed was approximately 2.2A. A flow rate was recorded following the cut-off of the PVC re-grind rod, at 15RPM, and an output of 3.696 lbs/hr was recorded. An average of 6365.5 PSI was recorded from the testing of all ten samples, with a range of 630 PSI (Table 1).

The PVC Virgin compound was found to run produce a slightly higher amount of pressure with an average of approximately 1800 PSI produced throughout the extrusion process. The PSI did fluctuate from around 1700 PSI to 1900 PSI. An average amps reading of 3.3A was observed. A flow rate was also performed for the PVC virgin compound at 15RPM with the result being 3.4lbs/hr. An average of 6411.1 PSI was recorded from the testing of all ten samples, with a range of 525 PSI.

Conclusion

Having found out that the PVC re-grind compound operates at 99.3% strength of the original virgin compound, the next step is to ensure that it is able to be effectively molded into a range of different mold sizes.

Appendix (chart and photos)

PVC (000655)								
	Regrind			Notes	Virgin			Notes
	Raw Pull Force				Raw Pull Force			
	Kg	MPa/mm ²	PSI		Kg	MPa/mm ²	PSI	
Test 1	59.6	43.1	6257.3		59.0	42.7	6195.3	
Test 2	60.5	43.8	6352.8		61.5	44.5	6457.8	
Test 3	61.0	44.2	6405.3		62.5	45.2	6562.8	
Test 4	57.5	41.6	6037.8		59.5	43.1	6247.8	
Test 5	61.0	44.2	6405.3		58.5	42.4	6142.8	
Test 6	59.0	42.7	6195.3		63.5	46.0	6667.8	
Test 7	61.5	44.5	6457.8		61.0	44.2	6405.3	
Test 8	63.5	46.0	6667.8		61.5	44.5	6457.8	
Test 9	62.0	44.9	6510.3		62.5	45.2	6562.8	
Test 10	61.0	44.2	6405.3		61.5	44.5	6457.8	
AVG	60.6	43.9	6365.5		61.1	44.2	6411.1	

Table 1: A table showing the results of all pull tests on the two PVC compounds

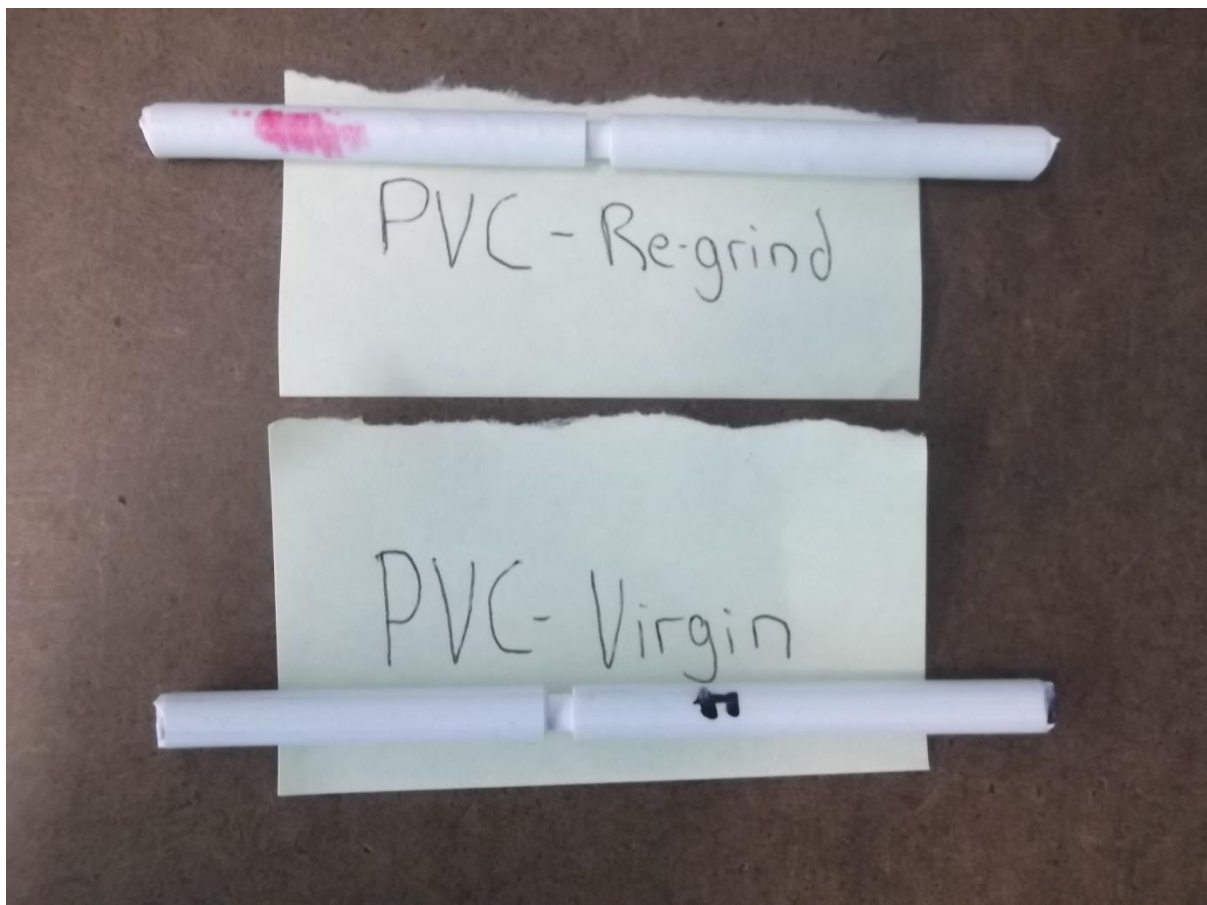


Figure 1: A comparison of both samples

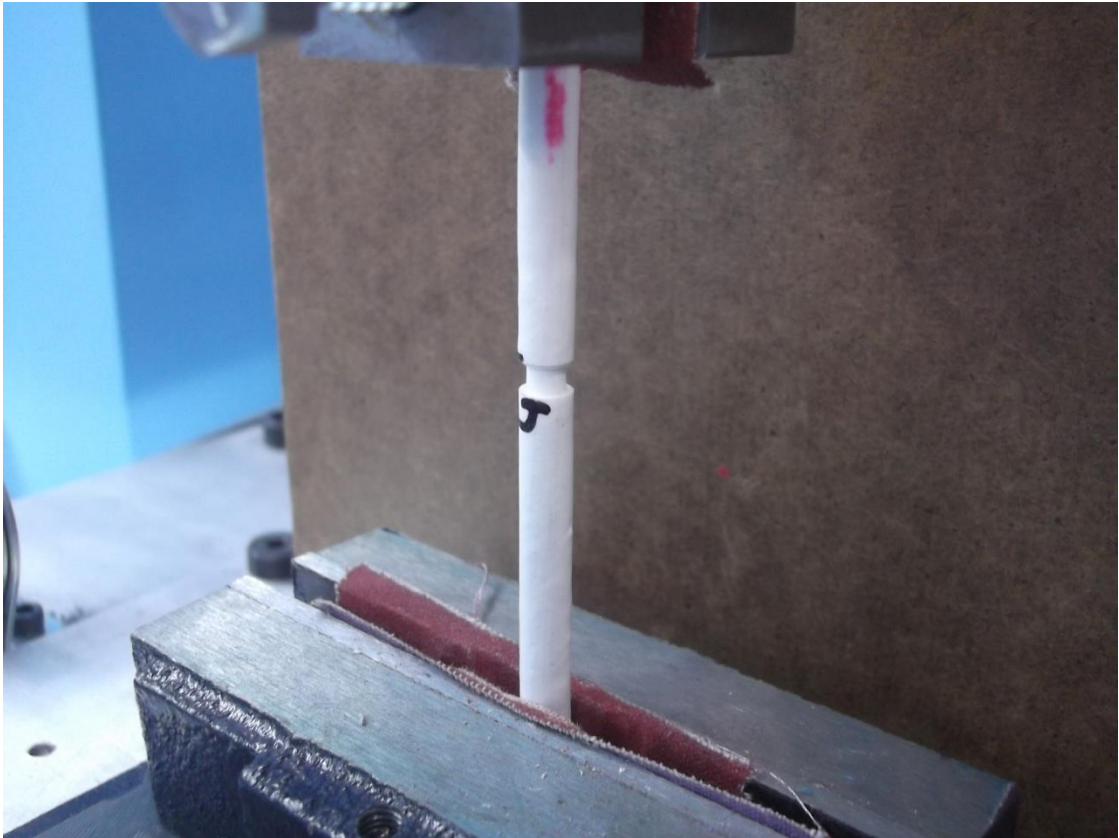


Figure 2: An unbroken sample in the pull testing machine

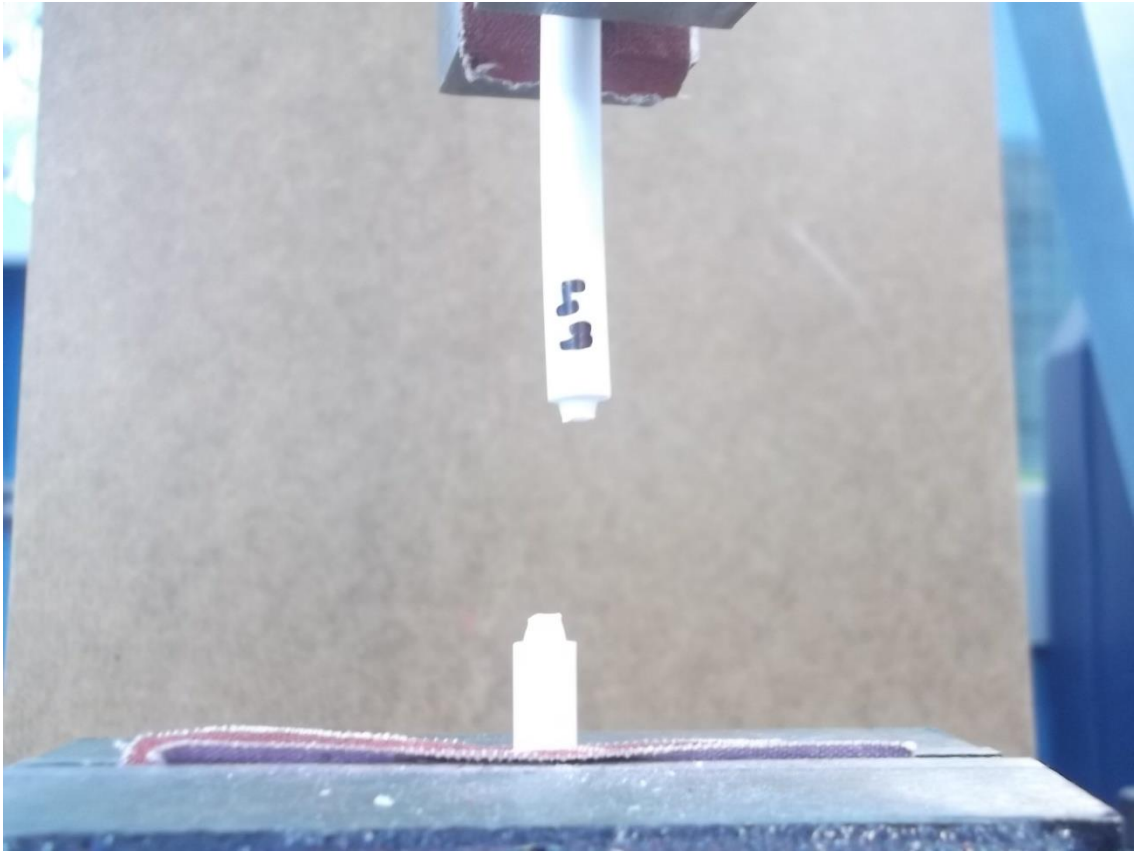


Figure 3: A broken sample in the testing setup

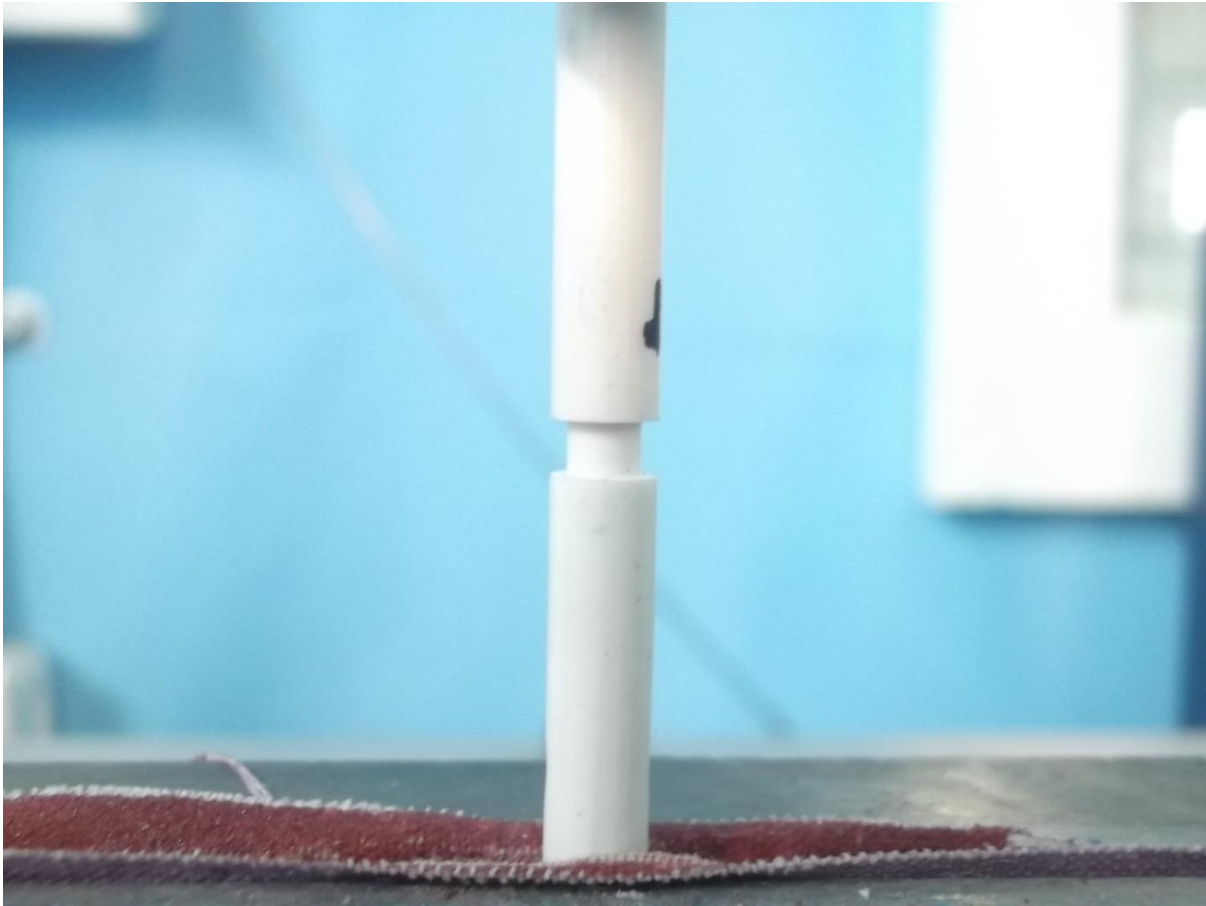


Figure 4: The 1/8" area on a sample turned that was turned down to 0.162" dia.