

Stronger recycled plastics

SIR — Recycled plastics often possess relatively poor mechanical properties in comparison with products made from virgin materials. In particular, recycled plastic packaging materials are derived largely from polyolefins of low strength, weakened further by impurities in the recycled feedstock. Blending of a more rigid polymer with a polyolefin to form a stronger alloy is appealing economically but polymers commonly used by the packaging industry tend to be highly incompatible with each other^{1,2}. These problems notwithstanding, we have achieved good and consistent

mechanically tested. Both compressive³ and tensile⁴ properties were consistently either equal to or greater than values calculated by assuming a linearly weighted sum of contributions due to the pure components, for compositions up to 40 per cent PS. At 35 per cent PS, the stiffness (modulus) was optimal and anomalous, being 108 per cent (approximately 2 times) greater than that for pure PE.

Electron micrographs (see figure) of fracture surfaces reveal the size, shape and distribution (morphology) of each of the two components. For compositions up to 30 per cent PS, drawn fibres of PS are dispersed uni-

terized by more extensive regions of PS and thinner areas of PE. This dissolution of the uniformly entangled morphology is correlated with a decrease in the modulus.

We do not as yet fully understand why these blends have properties superior to those reported in previous studies, but this discovery strongly suggests that recycled blends made from incompatible polymer pairs may be formulated and processed in such a manner as to produce composite materials with good mechanical properties.

T. J. NOSKER

D. R. MORROW

R. W. RENFREE

Center for Plastics Recycling Research,
Rutgers,

The State University of New Jersey,
Piscataway, New Jersey 08855, USA

K. E. VAN NESS

J. J. DONAGHY

Department of Physics and
Engineering,

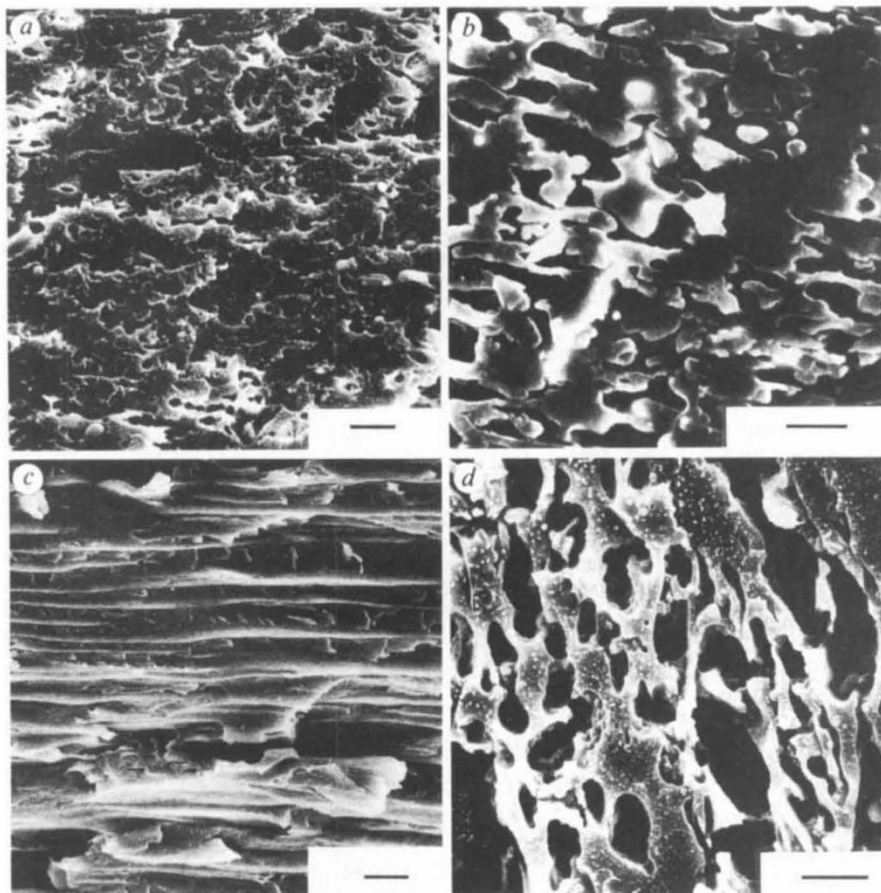
Washington and Lee University,
Lexington, Virginia 24450, USA

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Scanning electron micrographs of the surfaces of PS/PE blends. All samples shown were fractured at liquid-nitrogen temperature. Unless otherwise indicated, toluene was used to extract the PS phase, which appears as the darker of the two phases. *a*, 30/70 PS/PE. The surface is parallel to the length of the profile. Dark, circular/elliptical holes represent cross-sections of fibres/plates of PS in a matrix of PE. *b*, 35/65 PS/PE. Perpendicular view showing entangled phases. *c*, 35/65 PS/PE (no solvent extraction). The surface is parallel to the length of the profile. A laminate of rods and plates of PS and PE is evident. *d*, 40/60 PS/PE. Perpendicular view showing nonuniformity of the mixture and increase in extent of the PS phase. Scale bars, 10 μm .

mechanical properties in a blend of two of the most common packaging materials, polyethylene (PE) and a more rigid polymer, polystyrene (PS).

The PE component was derived from post-consumer plastic containers. Post-industrial PS scrap was mixed with the PE in various weight ratios. The molten mixtures were moulded into shapes with long, linear profiles of constant cross-section, and were

formly throughout a continuous matrix of PE; the morphology is similar to that of a fibre-reinforced composite, with the fibres down parallel to the length of the profile. At 35 per cent PS, the morphology is relatively uniform, with both polymers forming continuous phases that are entangled or interlocked. This morphology may be related to the enhanced strength at this composition. At 40 per cent PS, the morphology is charac-

Stretching a point

SIR — Those of us who do not work on the major histocompatibility complex (MHC) were very impressed to read in P. Parham's News and Views (*Nature* **348**, 674; 1990) that the MHC region of the genome is about 500 megabases in size. This would require about 17 per cent of the entire mammalian genome! Perhaps many of us have been unwittingly working on the MHC after all. Alternatively, is it possible that one or two extra zeros have crept in?

SHELDON I. FEINSTEIN

Department of Human Genetics
and Institute for Environmental
Medicine,
School of Medicine,
University of Pennsylvania,
Philadelphia,
Pennsylvania 19104-6068, USA

[Somehow everything becomes bigger in California. PETER PARHAM]

Scientific Correspondence

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