Review and comparison of methods to measure paper fracture energy

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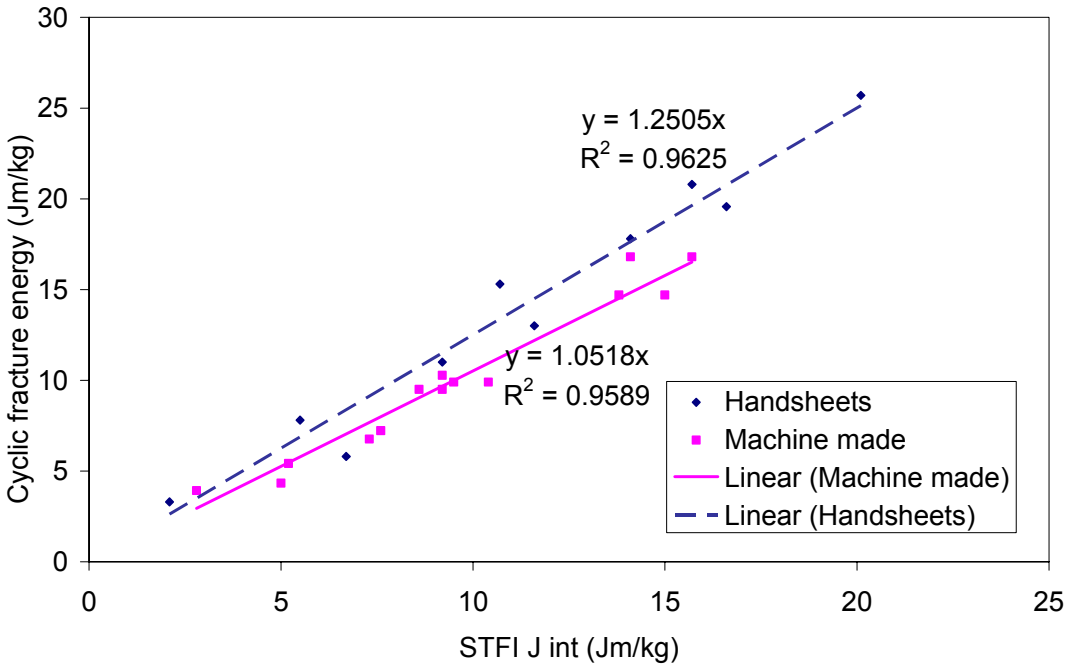
Fracture energy and its relationship to paper runnability remains a topic of on-going interest. A number of measurement techniques have been developed to measure the fracture energy of paper. These include single specimen, multiple specimen and Liebowitz non-linear forms of the J-integral technique *[1]*, the Essential Work of Fracture (EWF) method *[2]* and a variant simplified form using cyclic loading *[3]*, and the measurement of the energy consumed in cohesive crack opening *[4]*. A modified form of the Liebowitz non-linear fracture energy has been developed as a commercial instrument by STFI *[5, 6]*.

For the work presented here, fracture energy was measured for a range of commercial and laboratory-made papers using the four different techniques: the EWF and cyclic fracture energy, the cohesive crack opening energy consumption and the STFI method.



The results showed that all the fracture energy measurements were linearly related to each other. The figure shows the relationship between the cyclic fracture energy and the STFI fracture energy. The cyclic fracture energy values were 25% and 5% higher than the STFI fracture energy values, for the handsheets and machine made papers, respectively. The EWF values were about the same as the cyclic fracture energies. The cohesive crack opening measurements were found to give a fracture energy 25% lower than the STFI fracture energy. The results suggest that all measurement techniques are essentially determining similar quantities. The causes of the differences between the values measured by the techniques will also be discussed.

References

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