

In-line Instrumental Method for the Estimation of the Homogeneity of Polyolefines (Ingenious)

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Problem statement

Particles of highly entangled molecules or even cross-linked polymer, referred to as **gel particles**, constitute a major quality problem for applications such as blown films and cable insulation.

State of art and project goal

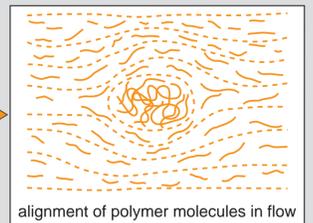
Gel determination and counting by optical or mechanical inspection of cast or blown films

Elaborate and costly, but highly accurate

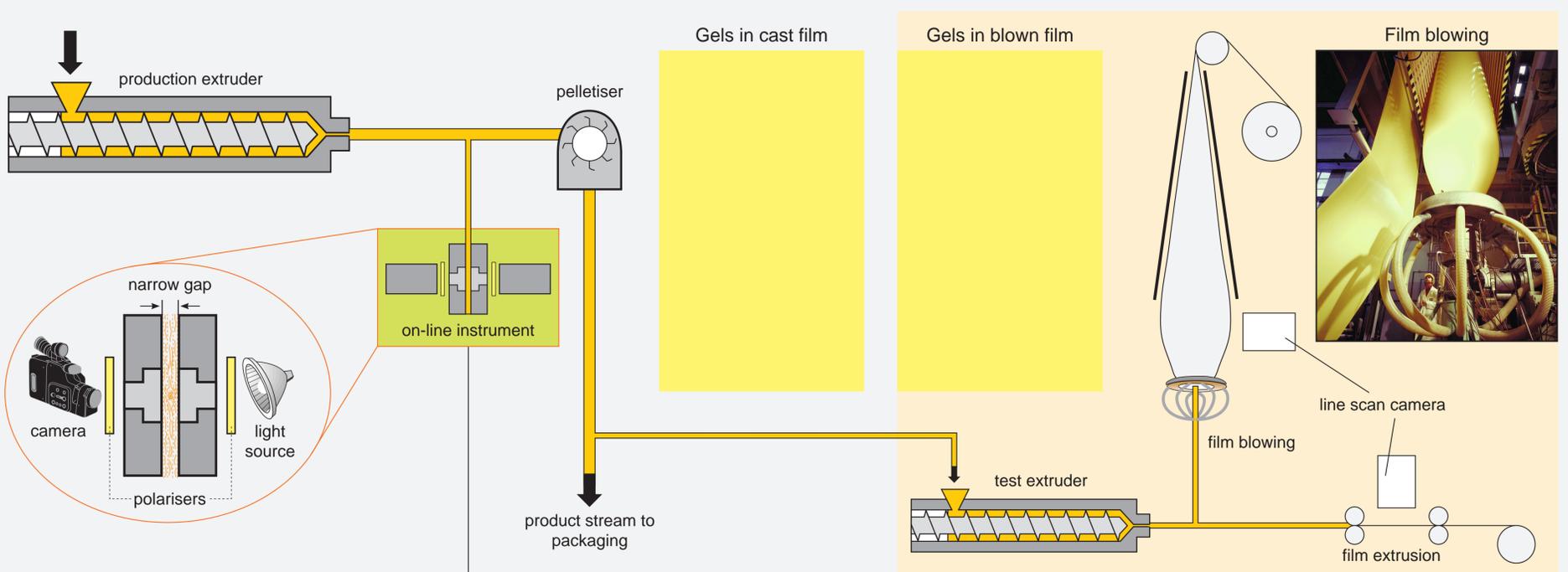
Goal: Detection of transparent gels directly in the melt stream

Solution (Physical background)

- Steady state degree of polymer chain orientation depends on molar mass (at given shear rate temperature)
- Molecules in gel particles are less oriented than matrix and cause a flow field perturbation
- Polarisation microscopy is sensitive to chain orientation
- Characteristic „Maltese cross” pattern appears, see image below



Implementation



Instrument attached to extruder

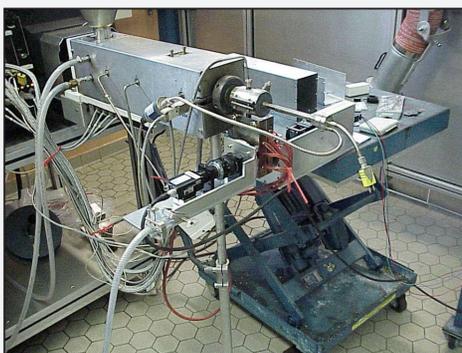
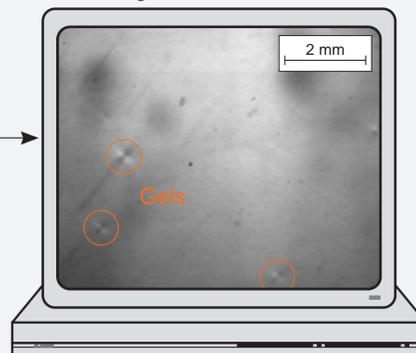


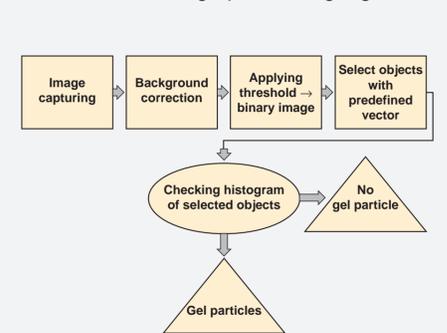
Photo of the on-line instrument



Gel recognition and measurement



Flow sheet of image processing algorithm



Results

Test material:

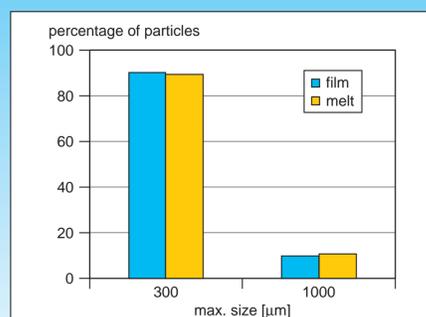
Blend of 10% high molecular weight HDPE (long linear chain) and 90% low molecular weight HDPE (short chain)

Results:

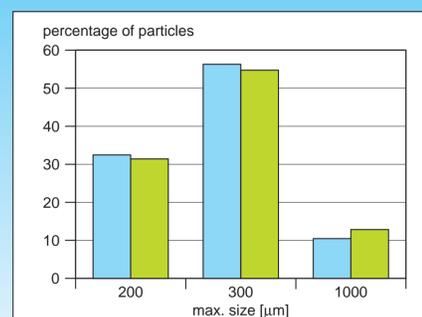
Comparison of gel detection methods left: comparison of film (conventional) and melt (polarisation microscopy) inspection

right: reproducibility of results of melt inspection method

Comparison of film and melt inspection



New melt inspection method: Reproducibility of results



Acknowledgement

We thank the EU-Commission for their financial contribution to the project under contract number SMT4-CT97-2163.

A patent for the instrument described on this poster has been applied for.