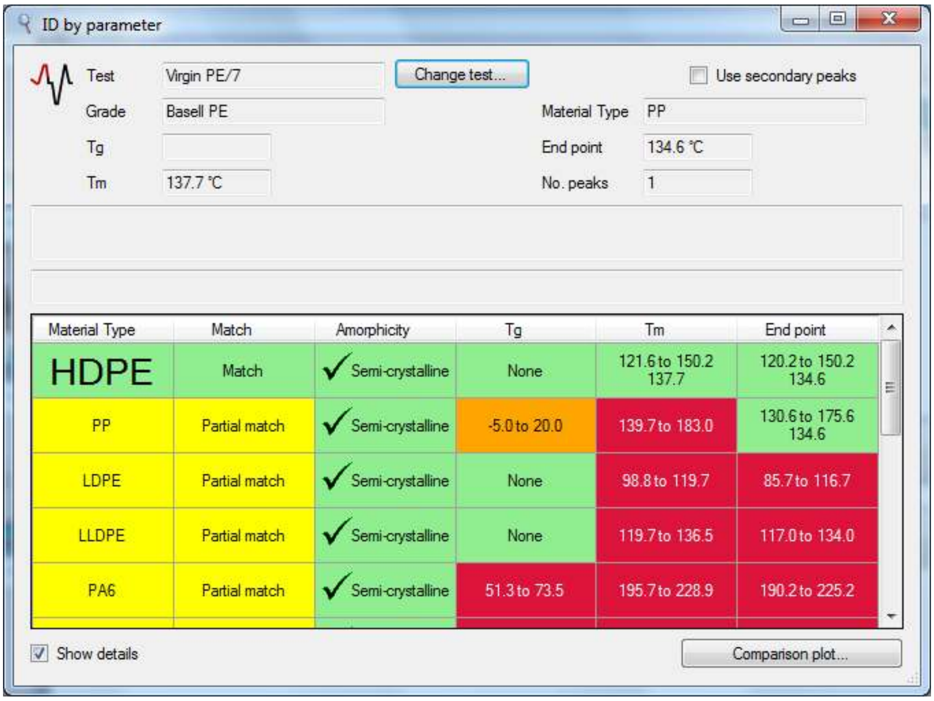
identiPolQA

ID 10 – Identification example of High Density Polyethylene (HDPE)

identiPolQA identification check of one of the most commonly used plastics, HDPE. The identification was made on the four parameters shown below. Amorphicity, Tg, Tm and End Point. A glossary can be found overleaf explaining these parameters and also how they are measured.

Property	Result
Amorphous / Semi-crystalline	Semi-crystalline
Glass transition, Tg	Not measurable above room temperature
Melting point, Tm	Within range
End Point	Within range



The table above illustrates how the plastic has been correctly and unambiguously identified as HDPE, based upon matching the parameters stored within the **identi**PolQA memory.

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Glossary

Amorphous
A material with no regular crystalline structure. Such plastics exhibit a glass transition or softening point, but have no melting point. Polystyrene and polycarbonate are examples of amorphous plastics.

Differential Scanning Calorimeter (DSC)
A Thermal Analysis instrument frequently used for the melting point determination of plastics. It also yields the energy of a melting process, which can be used to assess the level of crystallinity in a plastic (see Level of crystallinity).

End Point
This parameter in the **identi**PolQA refers to the point where the plastic no longer registers on the stiffness measurement, i.e. the plastic is a liquid. It can be correlated to the Vicat softening temperature and is a very reliable indicator of plastics' properties. A difference of 1°C is frequently significant.

Glass transition, Tg
The temperature where the molecules of a plastic start to become mobile. Depending on the nature of the plastic, it may soften slightly, e.g. high viscosity PVC used for extrusion, or flow easily, e.g, Polystyrene and polycarbonate. Tg is a softening point, but not a melting point (see Melting Point).

Level of crystallinity
In semi-crystalline plastics the level of crystallinity can have a big effect on the mechanical properties of a product. Therefore differences in plastic molecular weight and addition of nucleating agents can make large differences to product performance, e.g. impact strength.

Melt Flow Index, MFI or MFR
MFI is defined as the mass of plastic flowing through a capillary die of a specific diameter and length. A prescribed temperature and mass are used and details can be found in ASTM D1238 and ISO 1133. The result is the mass of plastic flowing from the die in ten minutes. This gives an indication of the processability of the plastic, in terms of how easily it will flow when softened. E.g. for PP extrusion grades the MFI is low, e.g. ≈0.3g/10 min, whereas for moulding grades it is higher ≈12g/10 min.

Melting Point
The temperature at which a crystalline plastic melts. Due to the high and disperse molecular weights of plastics, this is usually a broad melting peak, unlike the sharp transition seen for simple molecules, e.g ice/water. The energy evolved when a plastic melts can be used to assess the level of crystallinity in a DSC instrument (see Differential Scanning Calorimeter).

Quality Index Score (QIS)

Chemometrics data analysis routine used in **identiPolQA** in Quality Assurance

A value of 10 indicates that samples are identical, whilst 0 means that it is the wrong material. An acceptance threshold level can be set (usually 7), where any sample scoring 7 or greater is a PASS and any scoring below this level is a FAIL. An inexperienced operator can PASS or FAIL material on this basis. Batches of material scoring 7 to 10 are acceptable for processing. The QIS is based on comparing tan δ curves vs temperature.

Semi-crystalline
Many common plastics are semi-crystalline, e.g. polyethylene, polypropylene and polyamides (nylons). They are composed of two phases, one crystalline and the other amorphous (see Amorphous). These phases are chemically identical, but have different physical properties. The amorphous phase exhibits a glass transition, Tg, which is always below the melting point of the crystalline phase. The amount of softening seen at Tg will decrease in proportion to the amount of crystalline phase present.

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