

## How to Identify Plastics

Here is a preliminary guide that will help you to identify many of the basic types of plastics using simple techniques and readily available tools. Naturally, these tests should be used only for tentative identification because some complex plastic compounds require a rigorous analysis for identification.

To initially determine whether a material is thermoset or thermoplastic, heat a stirring rod (to about 500°F/260°C, the material is a thermoplastic; if not, it is probably a thermoset.

Next, hold the sample to the edge of a flame until it ignites. (Hold in the flame for about 10 seconds if no flame is produced immediately.) If the material burns, note the nature of the smoke, the presence of soot in the air and, if while burning, the sample drips.

Next, extinguish the flame and cautiously smell the fumes. (In identifying the odor, a known sample is most helpful for comparison.) Finally, check your observations against the known characteristics of each plastic given on page 93. Once you have made a tentative identification, it is usually desirable to make one additional test to confirm the results of the original identification. Remember additives may affect results; for example, flame retardants would mask the polymer's normal burning characteristics.

| Materials                    | No Flame                             | Burns, but Extinguishes on Removal of Flame Source |                          |                     | Continues to Burn after removal of Flame Source |                     |                        |                   | Remarks  |
|------------------------------|--------------------------------------|--|--------------------------|---------------------|---|---------------------|------------------------|-------------------|--|
|                              | Odor                                 | Odor   | Color of Flame           | Drips               | Odor  | Color of Flame      | Drips                  | Speed of Burning  |  |
| <b>THERMOPLASTICS</b>        |                                      |  |                          |                     |   |                     |                        |                   |  |
| <b>ABS</b>                   |                                      | Acrid  | Yellow, blue edges       | No                  | Acrid   | Yellow, blue edges  | Yes                    | Slow              | Black smoke with soot in air                                 |
| <b>Acetals</b>               | -                                    | -  | -                        | -                   | Formaldehyde                                    | Blue, no smoke      | Yes                    | Slow              |  |
| <b>Acrylics</b>              | -                                    | -  | -                        | -                   | Fruity  | Blue, yellow tip    | No (cast) Yes (molded) | Slow              | Flame may spurt if rubber modified                           |
| <b>Cellulosics</b>           |                                      |  |                          |                     |   |                     |                        |                   |  |
| Acetate                      | -                                    | Vinegar  | Yellow with sparks       | No                  | Vinegar   | Yellow              | Yes                    | Slow              | Flame may spark  |
| Acetate Butyrate             | -                                    | -  | -                        | -                   | Rancid butter                                   | Blue, yellow tip    | Yes                    | Slow              | Flame may spark  |
| <b>Ethyl Cellulose</b>       | -                                    | -  | -                        | -                   | Burnt sugar                                     | Yellow, blue edges  | Yes                    | Rapid             | -  |
| Nitrate                      | -                                    | -  | -                        | -                   | camphor   | White               | No                     | Rapid             | -  |
| Propionate                   | -                                    | -  | -                        | -                   | Burnt sugar                                     | Blue, yellow tip    | Yes                    | Rapid             | -  |
| <b>Chlorinated Polyether</b> | -                                    |  | Green, yellow tip        | No                  | -   | -                   | -                      | -                 | Black smoke with soot in air                                 |
| <b>Fluorocarbons</b>         |                                      |  |                          |                     |   |                     |                        |                   |  |
| FEP                          | Faint odor of burnt hair             | -  | -                        | -                   | -   | -                   | -                      | -                 | Deforms; no combustion, but drips                            |
| PRTFE                        | Faint odor of burnt hair             | -  | -                        | -                   | -   | -                   | -                      | -                 | Deforms; does not drip                                       |
| CTFE                         | faint odor of acetic acid            | -  | -                        | -                   | -   | -                   | -                      | -                 | Deforms; no combustion, but drips                            |
| PVF                          | acidic                               | -  | -                        | -                   | -   | -                   | -                      | -                 | Deforms  |
| <b>Nylons</b>                |                                      |  |                          |                     |   |                     |                        |                   |  |
| Type 6                       | -                                    | -  | -                        | -                   | Burnt wool                                      | Blue, yellow tip    | Yes                    | Slow              | -  |
| Type 6/6                     | -                                    | Burnt wool or hair                                 | Blue, yellow tip         | Yes                 | -   | -                   | -                      | Slow              | More rigid than Type 6 nylon                                 |
| <b>Phenoxies</b>             | -                                    | Acrid <sup>d</sup>                                 | Yellow <sup>c</sup>      | No <sup>c</sup>     | Acrid <sup>d</sup>                              | Yellow <sup>d</sup> | Yes <sup>d</sup>       | Slow <sup>d</sup> | Black smoke with soot in air                                 |
| <b>Polycarbonates</b>        | -                                    | Faint, sweet aromatic ester                        | Orange                   | Yes                 | -   | -                   | -                      | -                 | Black smoke with soot in air                                 |
| <b>Polyethylenes</b>         | -                                    | -  | -                        | -                   | Paraffin  | Blue, yellow tip    | Yes                    | Slow              | Floats in water  |
| <b>Polyphenylene</b>         |                                      |  |                          |                     |   |                     |                        |                   |  |
| Oxides (PPO)                 | -                                    | Phenol   | Yellow-orange            | No                  | -   | -                   | -                      | -                 | Flame spurts; very difficult to ignite                       |
| Modified Grade               | -                                    | Phenol   | Yellow-orange            | No                  | -   | -                   | -                      | -                 | flame spurts; difficult to ignite, soot in air               |
| <b>Polyimides</b>            | <sup>b</sup>                         | -  | -                        | -                   | -   | -                   | -                      | -                 | Chars; material very rigid                                   |
| <b>Polypropylenes</b>        | -                                    | Acrid <sup>a</sup>                                 | Yellow <sup>a</sup>      | Yellow <sup>a</sup> | Sweet   | Blue, yellow tip    | Yes                    | Slow              | Floats in water; more difficult to scratch than polyethylene |
| <b>Polystyrenes</b>          | -                                    | -  | -                        | -                   | Illuminating Gas                                | Yellow              | Yes                    | Rapid             | Dense black smoke with soot in air                           |
| <b>Polysulfones</b>          | -                                    | <sup>b</sup>                                       | Orange                   | Orange              | -   | -                   | -                      | -                 | Black smoke  |
| <b>Polyurethanes</b>         | -                                    | -  | -                        | -                   | <sup>b</sup>                                    | Yellow              | No                     | Slow              | Black smoke  |
| <b>Vinyls</b>                |                                      |  |                          |                     |   |                     |                        |                   |  |
| Flexible                     | -                                    | Hydrochloric acid                                  | Yellow with green spurts | No                  | -   | -                   | -                      | -                 | Chars, melts   |
| Rigid                        | -                                    | Hydrochloric acid                                  | Yellow with green spurts | No                  | -   | -                   | -                      | -                 | Chars, melts   |
| <b>Polyblends</b>            |                                      |  |                          |                     |   |                     |                        |                   |  |
| ABS/Polycarbonate            | -                                    | -  | -                        | -                   | <sup>b</sup>                                    | Yellow, blue edges  | No                     | -                 | Black smoke with soot in air                                 |
| ABS/PVC                      | -                                    | Acrid  | Yellow, blue edges       | No                  | -   | -                   | -                      | -                 | Black smoke with soot in air                                 |
| PVC/Acrylic                  | -                                    | Fruity   | Blue, yellow tip         | No                  | -   | -                   | -                      | -                 |  |
| <b>THERMOSETS</b>            |                                      |  |                          |                     |   |                     |                        |                   |  |
| <b>Alkyds</b>                | -                                    | -  | -                        | -                   | -   | -                   | -                      | -                 | -  |
| <b>Diallyl Phthalates</b>    | -                                    | -  | -                        | -                   | Phenolic  | Yellow              | No                     | Slow              | Black smoke, cracks  |
| <b>Diglycol Carbonate</b>    | -                                    | -  | -                        | -                   | Acrid   | Yellow              | No                     | Slow              | Black smoke with soot  |
| <b>Epoxies</b>               | -                                    | -  | -                        | -                   | Phenol  | Black smoke         | No                     | Slow              | Black smoke with soot in air                                 |
| <b>Melamines</b>             | Formaldehyde and fish                |  | -                        | -                   | -   | -                   | -                      | -                 | -  |
| <b>Phenolics</b>             | Formaldehyde and phenol <sup>c</sup> | Phenol and wood or paper <sup>d</sup>              | Yellow <sup>d</sup>      | No                  | -   | -                   | -                      | -                 | May crack  |
| <b>Polyesters</b>            | -                                    | Hydrochloric acid <sup>a</sup>                     | Yellow <sup>a</sup>      | No <sup>a</sup>     | <sup>b</sup>                                    | Yellow, blue edges  | No                     | Slow              | Cracks and breaks  |
| <b>Silicones</b>             | <sup>b</sup>                         | -  | -                        | -                   | -   | -                   | -                      | -                 | Deforms  |
| <b>Ureas</b>                 | Formaldehyde                         | -  | -                        | -                   | -   | -                   | -                      | -                 | -  |

<sup>a</sup>Flame retardant<sup>b</sup>Nondescript<sup>c</sup> Inorganic filler<sup>d</sup>Organic filler

Ref: Materials Engineering, Penton/IPC, Cleveland, Ohio