Helium, which is used as a carrier gas for GC-MS, has in recent years been subject to dramatic price increases and delivery delays. This can, in some cases, make it difficult to obtain Helium. Equipped with a newly developed turbomolecular pump, the GCMS-QP2020 can be operated using replacement carrier gases, such as hydrogen and nitrogen. The measurement range guidelines for each carrier gas is shown in Fig. 1. Although nitrogen provides less sensitivity than helium, its price is ten times lower and it is easily available.

This application data sheet introduces an analysis of the instantaneous pyrolysis of an electronic circuit board using Py-GC/MS, while comparing the usage of nitrogen versus helium as the carrier gas.

**Conversion of Analysis Methods**

In changing the carrier gas from helium to nitrogen, the length of the column was changed from 30 m to 20 m and the inner diameter was changed from 0.25 mm to 0.18 mm. The analysis conditions were converted using the web-based “EZGC™ Method Translator”* provided by Restek Corporation (http://www.restek.com/ezgc-mtfc). For more information regarding the “EZGC™ Method Translator,” refer to Application Data Sheet No. 120. The analysis conditions for analyses using helium and nitrogen as the carrier gas are shown in Table 1.

Table 1: Analytical Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Helium Carrier Gas</th>
<th>Nitrogen Carrier Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrolyzer</td>
<td>Multi-Shot Pyrolyzer EDA/PY-3030D</td>
<td>Multi-Shot Pyrolyzer EDA/PY-3030D</td>
</tr>
<tr>
<td>GC-MS</td>
<td>GCMS-QP2020</td>
<td>GCMS-QP2020</td>
</tr>
<tr>
<td>Glass insert</td>
<td>Deactivated split glass insert with wool (P/N: 225-20803-01)</td>
<td>Deactivated split glass insert with wool (P/N: 225-20803-01)</td>
</tr>
<tr>
<td>Analysis mode</td>
<td>Single shot</td>
<td>Single shot</td>
</tr>
<tr>
<td>Furnace temp.</td>
<td>600 °C (1 min)</td>
<td>600 °C (1 min)</td>
</tr>
<tr>
<td>Interface temp.</td>
<td>300 °C</td>
<td>300 °C</td>
</tr>
</tbody>
</table>

- **Helium carrier gas** -
  - Purity: 99.99 %
  - Gas purification filter: Click-ON triple trap (Helium Specific)
  - [GC]
    - Column: SH-Rxi™-5Sil MS (length 30 m, 0.25 mm I.D., df=0.25 μm)
    - Injection temp.: 300 °C
    - Column oven temp.: 40 °C (2 min) → 15 °C/min → 320 °C (10 min)
    - Injection mode: Split
    - Split ratio: 50
    - Flow control mode: Linear velocity (39.5 cm/sec)
    - Initial column flow: 1.2 mL/min
  - [MS]
    - Ionization mode: EI
    - Interface temp.: 300 °C
    - Ion source temp.: 230 °C
    - Acquisition mode: Scan
    - Scan event time: 0.3 sec
    - Scan range: m/z 60 to 600

- **Nitrogen Carrier Gas** -
  - Purity: 99.99 %
  - Gas purification filter: Click-ON triple trap
  - [GC]
    - Column: SH-Rxi™-5Sil MS (length 20 m, 0.18 mm I.D., df=0.18 μm)
    - Injection temp.: 300 °C
    - Column oven temp.: 40 °C (2 min) → 14.8 °C/min → 320 °C (10.15 min)
    - Injection mode: Split
    - Split ratio: 50
    - Flow control mode: Linear velocity (26.2 cm/sec)
    - Initial column temp.: 0.32 mL/min
  - [MS]
    - Ionization mode: EI
    - Interface temp.: 300 °C
    - Ion source temp.: 230 °C
    - Acquisition mode: Scan
    - Scan event time: 0.3 sec
    - Scan range: m/z 60 to 600

*1: EZGC™ Method Translator is a trademark of Restek Corporation.
The total ion current chromatograms (TICC) measured for the instantaneous pyrolysis of electronic circuit boards using helium and nitrogen as the carrier gases are shown in Fig. 2. By using the EZGC™ Method Translator, a nearly identical chromatogram pattern could be obtained. Table 2 shows the results of a library search of typical detected peaks using the NIST 14 mass spectral library, and Fig. 3 shows the mass spectrum for the Bisphenol A detected. Even when nitrogen is used as the carrier gas, the mass spectrum is virtually the same as that when helium is used as the carrier gas. This means that existing mass spectral libraries can be used as is. For qualitative applications or quantitative analysis at a μg/mL (ppm) level, it is possible that a transition to nitrogen carrier gas can be made.