IC154: AGC’s low equivalent weight (EW) ionomer dispersion grade

- Perfluorosulfonic acid (PFSA) ionomer dispersed into an aqueous media (ethanol/water)
  - PFSA ionomer is an ion-exchange polymer in acid form, which is made from perfluorosulfonyl vinyl ether (PSVE) / tetrafluoroethylene (TFE) copolymer

**Key Attributes**
- Contains high polymer solid
- Enables high power generation because of its high ion exchange capacity
- Has long-side-chain sulfonic acid groups and performs comparably or better than other ionomers with short-side-chain sulfonic acid groups, even with less ion exchange capacity
- Shows its maximum performance when used in the cathode which determines the power output, but can also be used in the anode

**Composition of IC154**

<table>
<thead>
<tr>
<th>Component</th>
<th>Content (wt%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFSA Polymer</td>
<td>27 ± 2</td>
</tr>
<tr>
<td>Ethanol</td>
<td>44 ± 4</td>
</tr>
<tr>
<td>Water</td>
<td>29 ± 4</td>
</tr>
</tbody>
</table>

**Basic Properties of IC154**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value or Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ion Exchange Capacity (IEC, H⁺ polymer basis)</td>
<td>1.25 meq/g ± 0.1</td>
</tr>
<tr>
<td>Equivalent Weight (EW, H⁺ polymer basis)</td>
<td>800 g eq/median</td>
</tr>
<tr>
<td>Viscosity (at 76 sec⁻¹)</td>
<td>180 mPa.s ± 100</td>
</tr>
<tr>
<td>Color (APHA/Na Hazen scale)</td>
<td>&lt;100 (Colorless, Transparent)</td>
</tr>
</tbody>
</table>

**Usage Example**

**Catalyst Layer**
- Catalyst: TEC10E50E (TKQ)
- WC: 0.8
- Pt: Cathode 0.1 mg/cm²

**Ink Preparation**
- Solid: 10 wt%
- Solvent ratio: Water/Ethanol = 1/1

**Dispersion**
- 300 rpm / 1 hr by planetary ball mill

**Annealing**
- 150°C, 15 minutes

**Applications**
- Proton Exchange Membrane Fuel Cell (PEMFC)
- Proton Exchange Membrane Water Electrolysis (PEMWE)

**PEMFC: Proton Exchange Membrane Fuel Cell**
Generates electricity by use of hydrogen and oxygen.

\[
\begin{align*}
H_2 & \rightarrow 2H^+ + 2e^- \\
H_2 + \frac{1}{2}O_2 + 2e^- & \rightarrow H_2O
\end{align*}
\]

\[
2H_2 + O_2 \rightarrow 2H_2O + \text{electricity} + \text{heat}
\]
Comparison between 
IC154 as LSC (Long-Side-Chain Sulfonic Acid Groups) EW800 
to SSC (Short-Side-Chain Sulfonic Acid Groups) EW700 
Shows Equivalent Performance

<table>
<thead>
<tr>
<th>Catalyst Layer</th>
<th>Ink Preparation</th>
<th>Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEC10E50E (TKK)</td>
<td>Solid: 10 wt%</td>
<td>300 rpm / 1 hr</td>
</tr>
<tr>
<td>Pt: Cathode 0.1 mg/cm²</td>
<td>Solvent ratio:</td>
<td>by planetary ball mill</td>
</tr>
<tr>
<td>Water/Ethanol = 1/1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Condition 1:** 80°C, 100% RH, 50 kPa H₂/Air

**Condition 2:** 95°C, 20% RH, 50 kPa H₂/Air

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**Supply Options**
- Available from 800g-dispersion (1L plastic bottle)

**Recommended Storage Conditions**
Please store at 0-30 °C in the original containers. Keep the container tightly sealed so that solvent evaporation does not cause a viscosity change. Store the container indoors, and avoid exposing the container to direct sunlight, rain, or snow. Please be careful not to freeze the IC154 in the winter. Please use it as soon as possible before the characteristics change.

**Handling Instructions**
- IC154 is a hazardous material that contains ethanol, a flammable solvent. Refer to Safety Data Sheet (SDS) for further handling information.
- Data listed here are measured values at AGC and are not guaranteed values.