Question: SGL Carbon SIGRACELL® graphite felts are provided as the electrode material for Scribner's Redox Flow Battery (RFB) cell fixture kit. Scribner offers two SIGRACELL felts: GFD4.6 EA (4.6 mm) and GFA6 EA (6 mm). Which thickness should I use and what are the differences between the two? What are GFD and GFA? How do thickness and other properties of the felt electrode impact RFB performance?

Answer: Scribner offers SGL Group's SIGRACELL® felts as part of its Redox Flow Battery (RFB) cell fixture kit. Two felts are available: 4.6 mm GFD (PAN-based) and 6 mm GFA (Rayon-based). SGL also manufactures thinner (1.5 to 3 mm) material, although Scribner does not currently have these items in stock. Both PAN-based and Rayon-based materials work well in flow batteries. Surface treatment of the felts is advised for both types. Surface treatment is beyond the scope of this Application Note; numerous publications on the type (chemical, thermal) and benefits (electro-activity, wettability) of oxidative surface treatments exist (see selection of references below).

GFA and GFD felts have different characteristics. GFA is "softer" than GFD and can be compressed up to 50% whereas the GFD should not be compressed to more than 30%. SGL's GFA material shows higher through plane resistivity but has the advantage of enhanced charge transfer reactions at the electrodes.

As a general rule, thinner felts will generate a higher pressure drop and hence the standard flow through design might not be the best option; flow-by cell configuration may be preferable for such felts. Thinner electrodes of the same material reduce the overall ohmic resistance contribution but may require higher electrolyte flow rates at different operating states (*e.g.*, high state-of-charge) due to the smaller "flow through" cross-section. In case of 4.6 mm or 6 mm felts, this effect might be negligible and only become apparent for electrodes thinner than 4.6 mm and for larger area cells (*e.g.*, stack dimensions).

The following tables summarizes some of these aspects. Included is GFD2.5 which is SGL's thinner standard material.

	Ohmic resistance	Electrochemical activity	Electrolyte transport
GFA 6	✓	✓✓✓	✓✓✓
GFD 4.6	✓✓	✓✓	✓✓✓
GFD 2.5	✓✓✓	✓	✓

✓good ✓✓better ✓✓✓ best

Papers on Effect of Compression

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