

# Supporting Information

## Preparation of Porous Stainless Steel Hollow-Fibers through Multi-Modal Particle Size Sintering towards Pore Engineering

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### 1. Tables and Figures

Table S1. Spinning conditions.

Sample	Dope Flow Rate (mL·h <sup>-1</sup> )	Air Gap (cm)	Bore Flow Rate (mL·h <sup>-1</sup> )	Bore Composition
SS <sub>10</sub> HF	300	3	100	Water
SS <sub>10/20</sub> HF	300	1.5	150	Water
SS <sub>10/44</sub> HF	300	1.5	100	Water

Table S2. Size distribution of stainless steel particles.

Metal Particles	Equivalent Spherical Diameter in DI Water (μm)			Equivalent Spherical Diameter in IP (μm)		
	d0.1	d0.5	d0.9	d0.1	d0.5	d0.9
SS <sub>10</sub>	3.1 ± 0.1	5.4 ± 0.1	8.6 ± 0.2	3.3 ± 0.1	6.1 ± 0.1	9.5 ± 0.2
SS <sub>20</sub>	2.5 ± 0.1	9.3 ± 0.1	20.2 ± 0.4	2.8 ± 0.1	10.8 ± 0.1	25.3 ± 0.2
SS <sub>44</sub>	17.3 ± 0.5	37.3 ± 1	71.9 ± 1.1	18.3 ± 0.1	39.3 ± 0.2	78.3 ± 0.4

Table S3. Metal powder properties: surface area, total BET surface area, average absolute density and relative density determined versus average bulk density of 316L grade stainless steel (8 g·cm<sup>-3</sup>).

Metal Powder	Surface Area (m <sup>2</sup> ·g <sup>-1</sup> )	Total BET Surface Area (m <sup>2</sup> )
SS <sub>10</sub>	0.034	0.087
SS <sub>20</sub>	0.036	0.096
SS <sub>44</sub>	0.052	0.139
	Average Absolute Density (g·cm <sup>-3</sup> )	Relative Density (%)
SS <sub>10</sub>	4.84	39.46
SS <sub>20</sub>	3.17	60.41
SS <sub>44</sub>	4.69	41.42
SS <sub>10/20</sub>	2.45	69.38
SS <sub>10/44</sub>	2.72	66.15

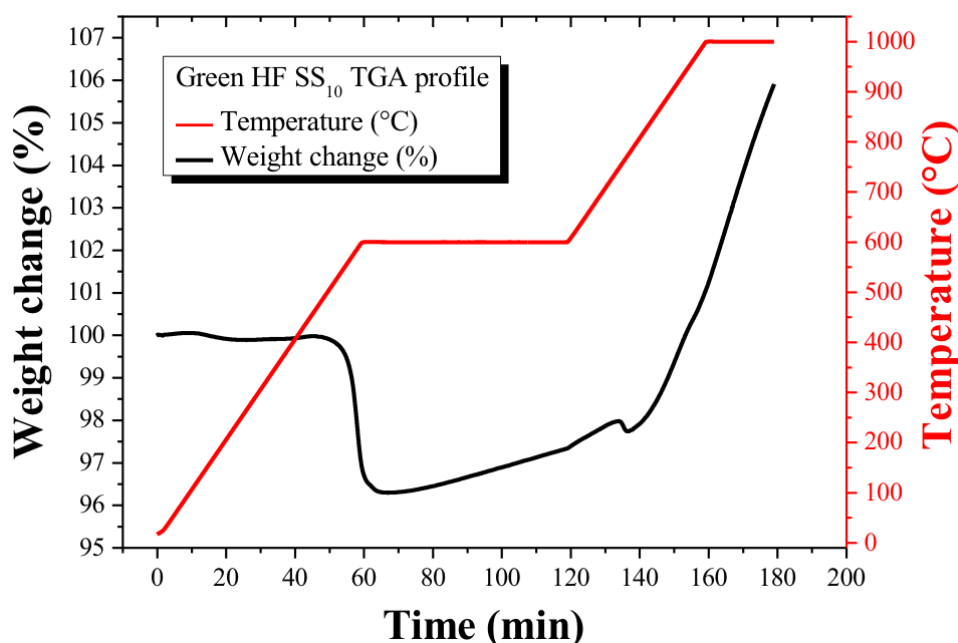
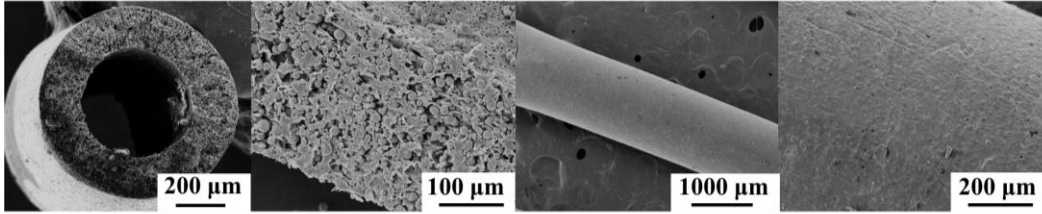
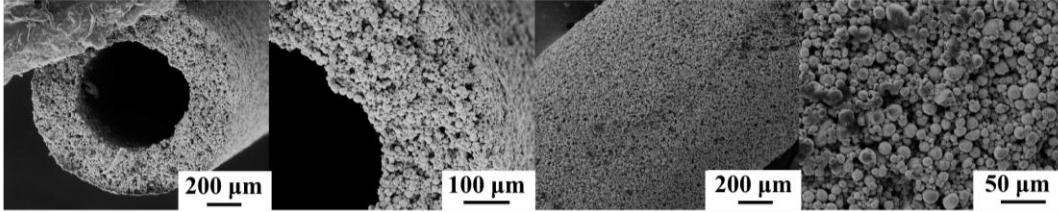


Figure S1. Thermal treatment and TGA profile of the green SS<sub>10</sub> HF in air atmosphere with a heating rate of 10 °C·min<sup>-1</sup>.

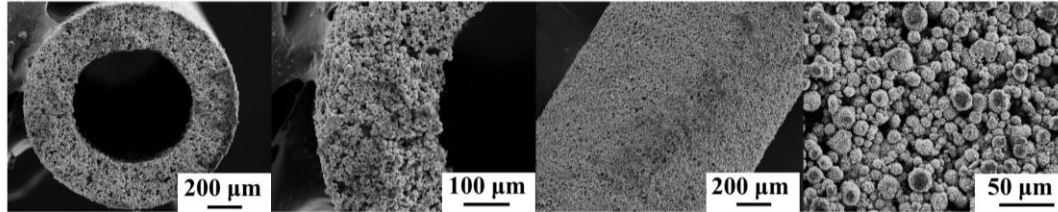
- Green SS<sub>10</sub> HFs



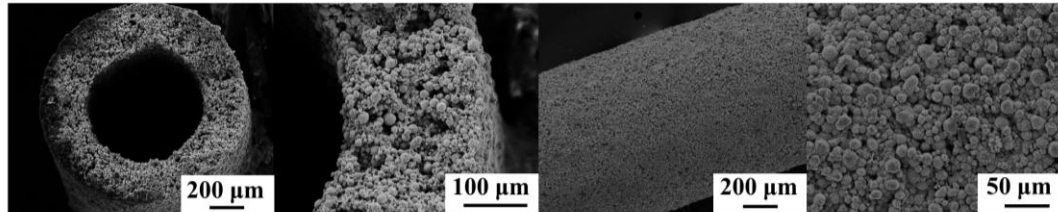
- SS<sub>10</sub> sintered 60 min at 650°C in N<sub>2</sub>:H<sub>2</sub> 15%



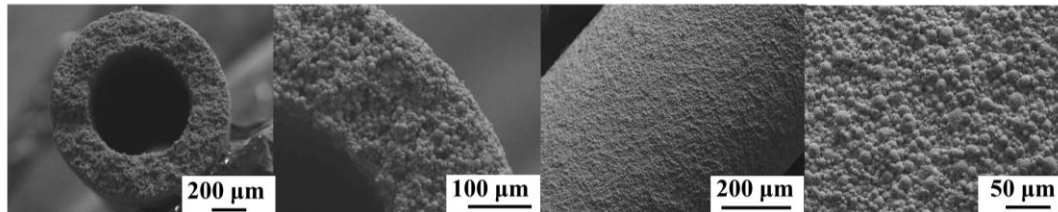
- SS<sub>10</sub> sintered 60 min at 700°C in N<sub>2</sub>:H<sub>2</sub> 15%



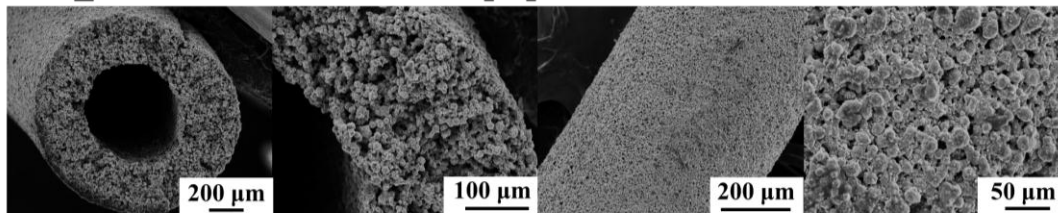
- SS<sub>10</sub> sintered 60 min at 800°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10</sub> sintered 60 min at 900°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10</sub> sintered 60 min at 1000°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10</sub> sintered 60 min at 1100°C in N<sub>2</sub>:H<sub>2</sub> 15%

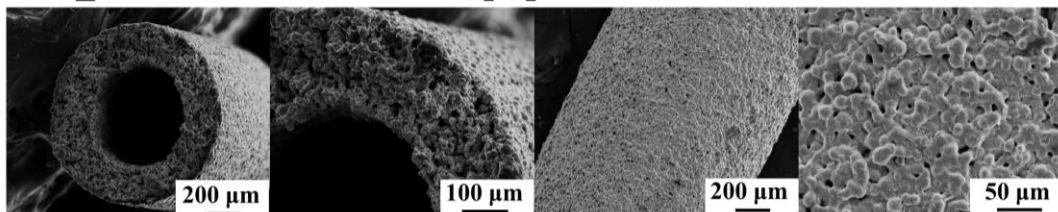
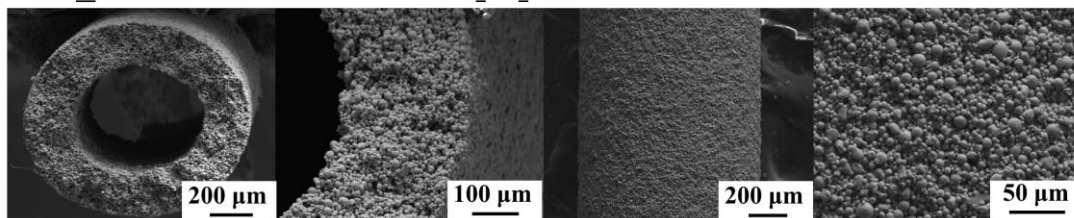
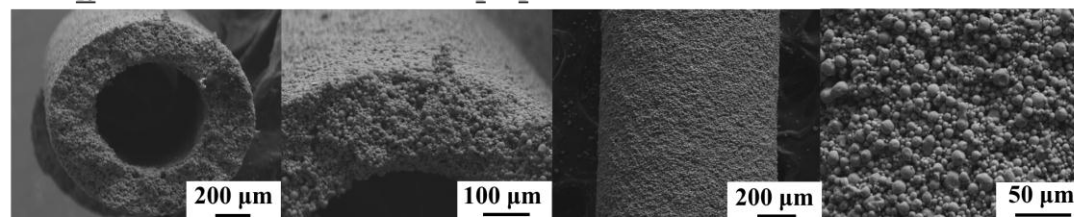


Figure 2. *Cont.*

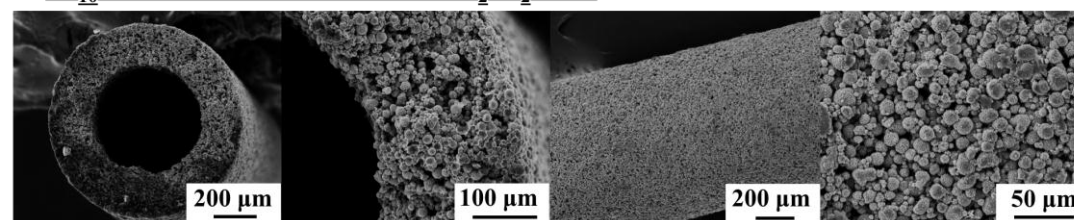
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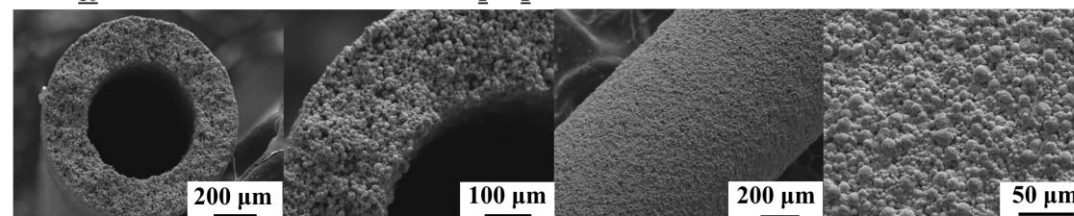
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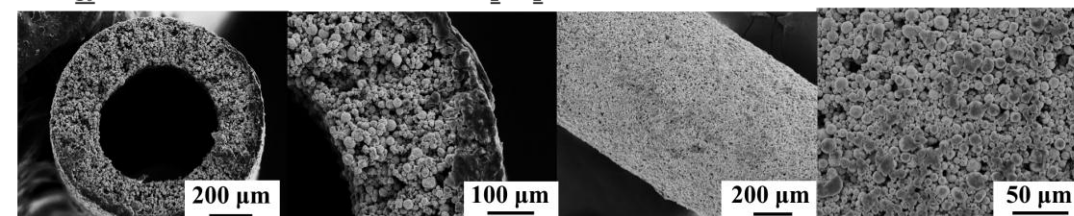
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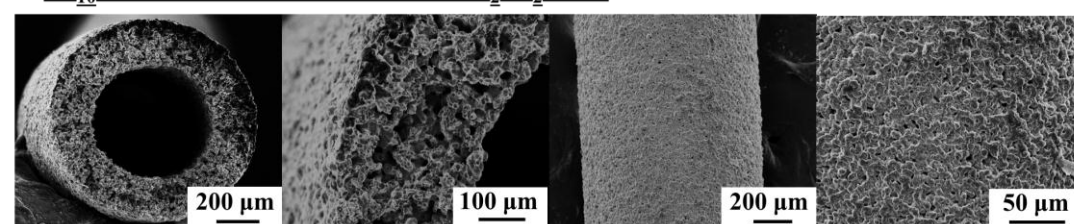
- SS<sub>10</sub> sintered 90 min at 900°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10</sub> sintered 90 min at 1000°C in N<sub>2</sub>:H<sub>2</sub> 15%

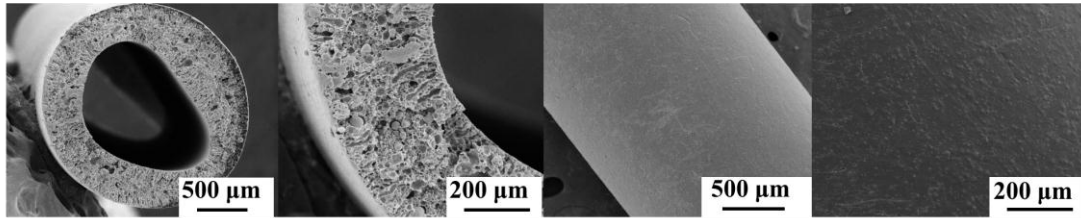


- SS<sub>10</sub> sintered 90 min at 1100°C in N<sub>2</sub>:H<sub>2</sub> 15%

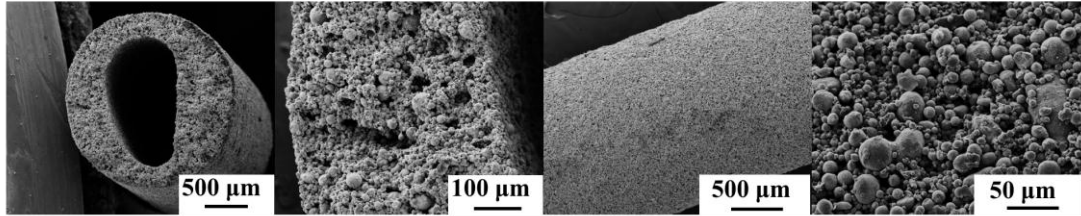


**Figure S2.** SEM images of the green and sintered SS<sub>10</sub> HF at temperature ranging from 650 to 1100 °C for 60 or 90 min.

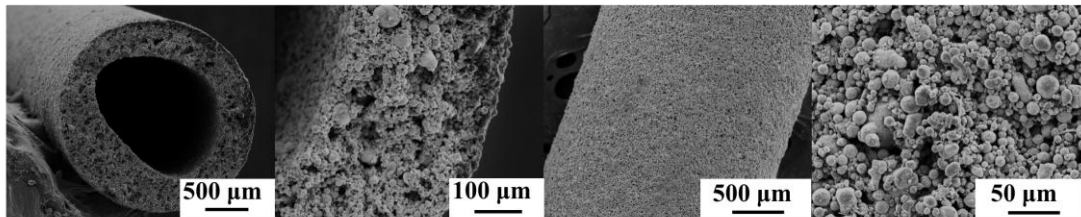
• Green SS<sub>10/20</sub> HFs



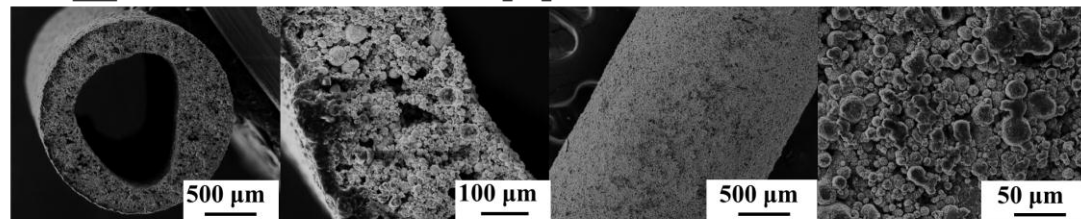
• SS<sub>10/20</sub> sintered 60 min at 650°C in N<sub>2</sub>:H<sub>2</sub> 15%



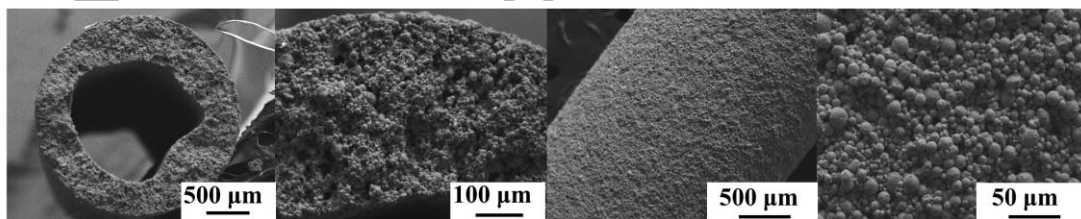
• SS<sub>10/20</sub> sintered 60 min at 700°C in N<sub>2</sub>:H<sub>2</sub> 15%



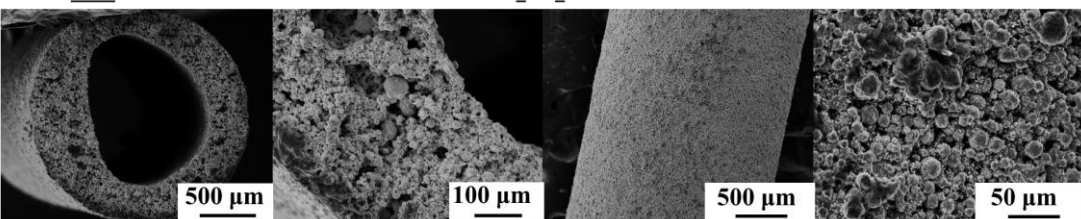
• SS<sub>10/20</sub> sintered 60 min at 800°C in N<sub>2</sub>:H<sub>2</sub> 15%



• SS<sub>10/20</sub> sintered 60 min at 900°C in N<sub>2</sub>:H<sub>2</sub> 15%



• SS<sub>10/20</sub> sintered 60 min at 1000°C in N<sub>2</sub>:H<sub>2</sub> 15%



• SS<sub>10/20</sub> sintered 60 min at 1100°C in N<sub>2</sub>:H<sub>2</sub> 15%

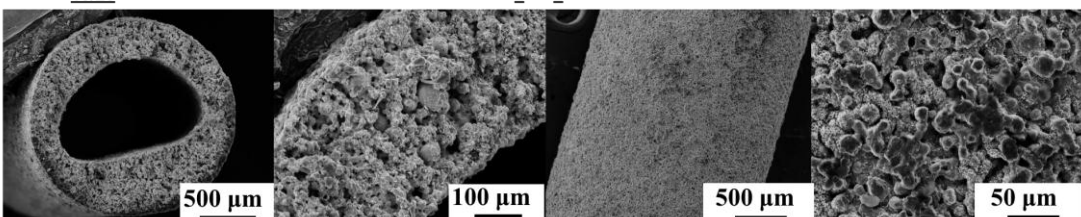
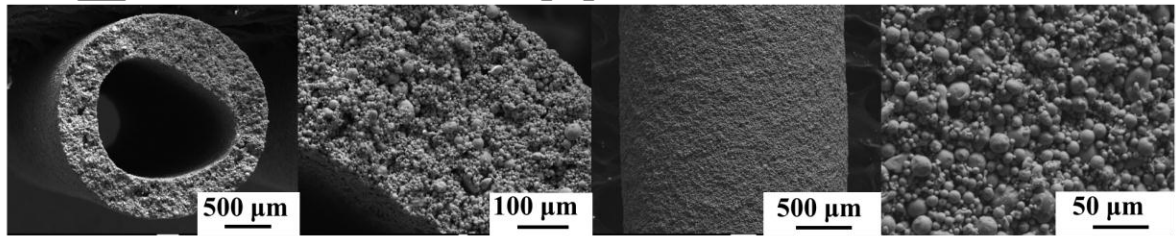


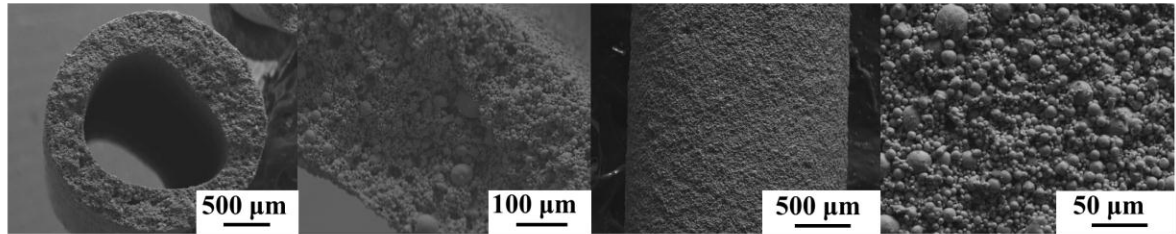
Figure 3. *Cont.*



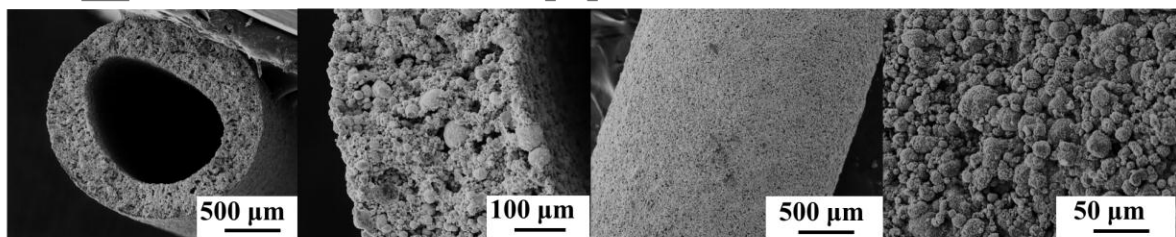
- SS<sub>10/20</sub> sintered 90 min at 650°C in N<sub>2</sub>:H<sub>2</sub> 15%



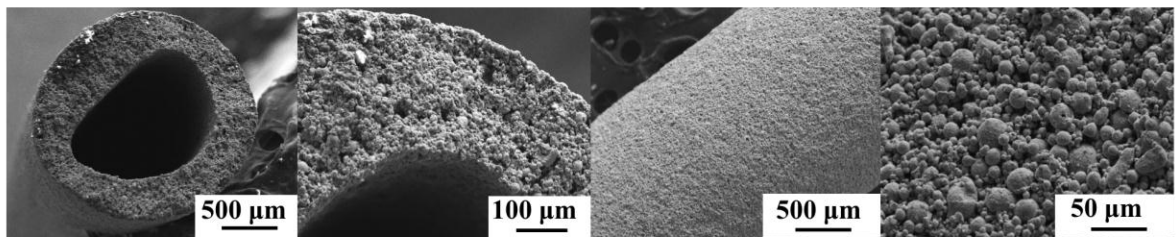
- SS<sub>10/20</sub> sintered 90 min at 700°C in N<sub>2</sub>:H<sub>2</sub> 15%



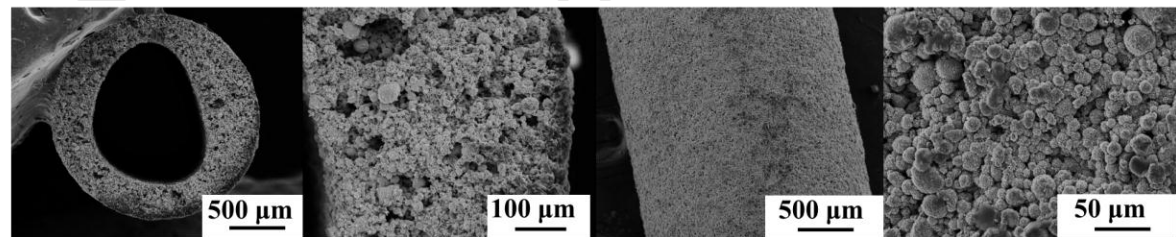
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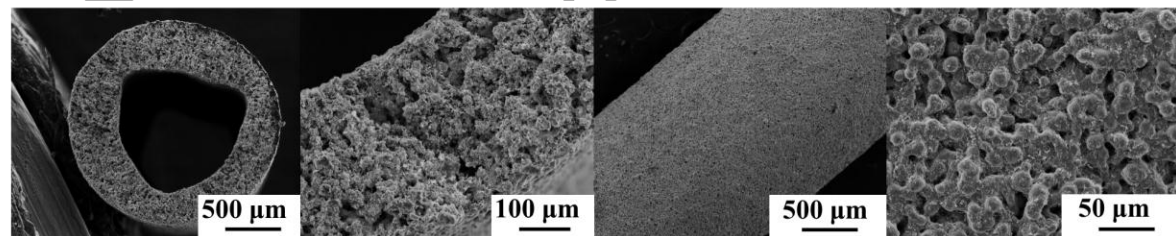
- SS<sub>10/20</sub> sintered 90 min at 900°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10/20</sub> sintered 90 min at 1000°C in N<sub>2</sub>:H<sub>2</sub> 15%

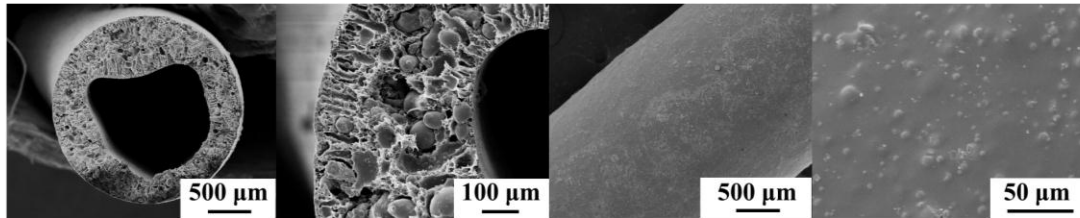


- SS<sub>10/20</sub> sintered 90 min at 1100°C in N<sub>2</sub>:H<sub>2</sub> 15%

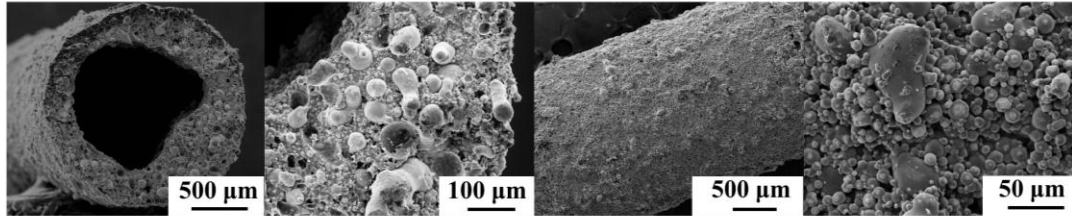


**Figure S3.** SEM images of the green and sintered SS<sub>10/20</sub> HF at temperature ranging from 650 to 1100 °C for 60 or 90 min.

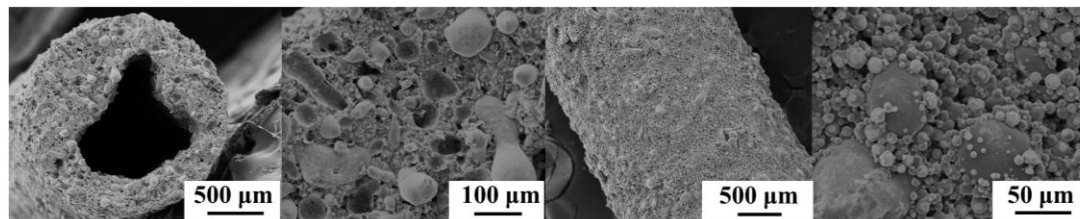
- Green SS<sub>10/44</sub> HFs



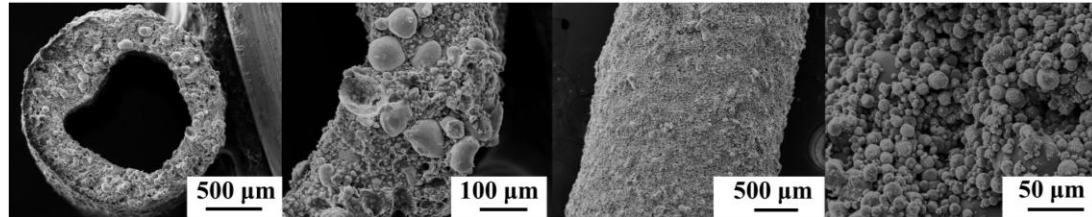
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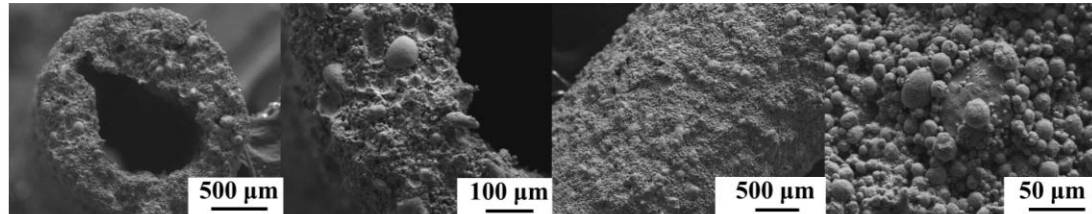
- SS<sub>10/44</sub> sintered 60 min at 700°C in N<sub>2</sub>:H<sub>2</sub> 15%



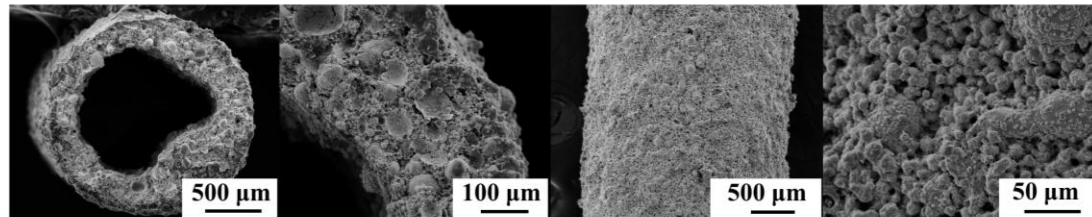
- SS<sub>10/44</sub> sintered 60 min at 800°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10/44</sub> sintered 60 min at 900°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10/44</sub> sintered 60 min at 1000°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10/44</sub> sintered 60 min at 1100°C in N<sub>2</sub>:H<sub>2</sub> 15%

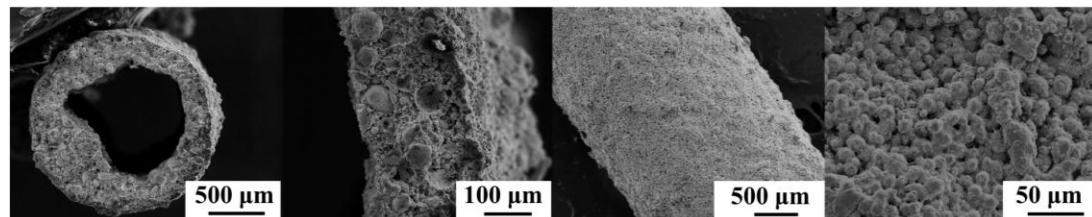
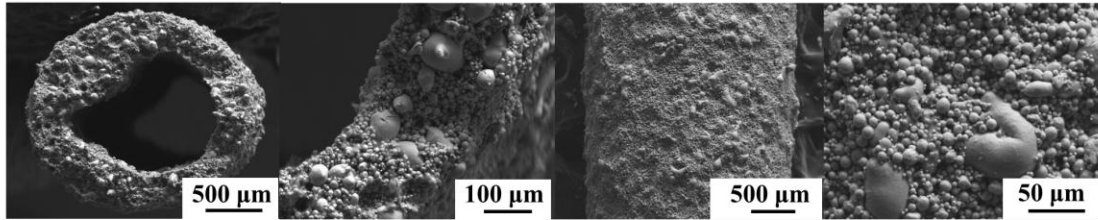
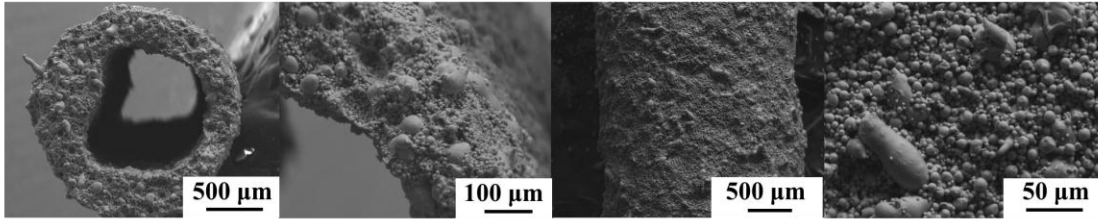


Figure 4. *Cont.*

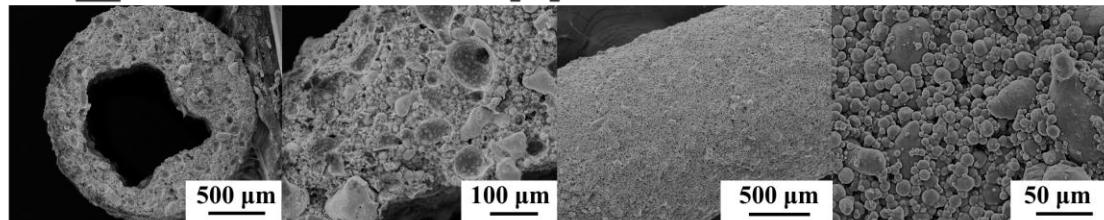
- SS<sub>10/44</sub> sintered 90 min at 650°C in N<sub>2</sub>:H<sub>2</sub> 15%



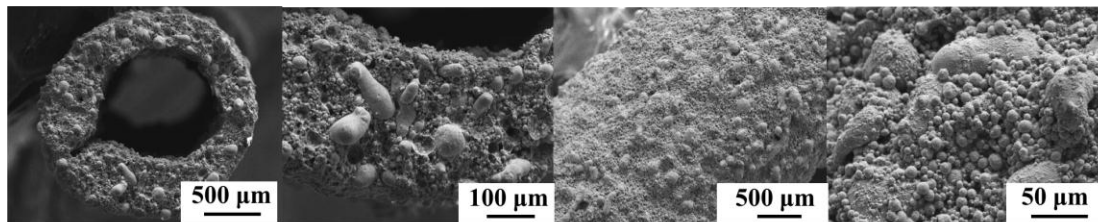
- SS<sub>10/44</sub> sintered 90 min at 700°C in N<sub>2</sub>:H<sub>2</sub> 15%



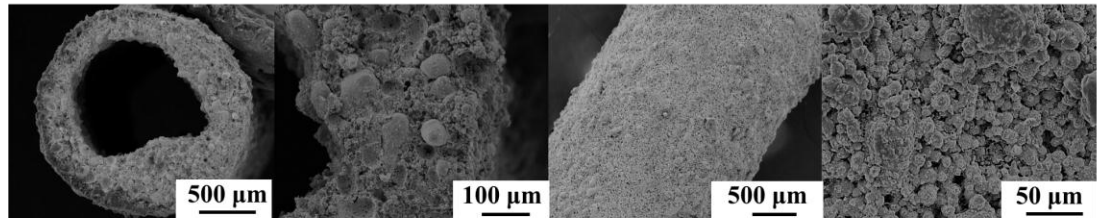
- SS<sub>10/44</sub> sintered 90 min at 800°C in N<sub>2</sub>:H<sub>2</sub> 15%



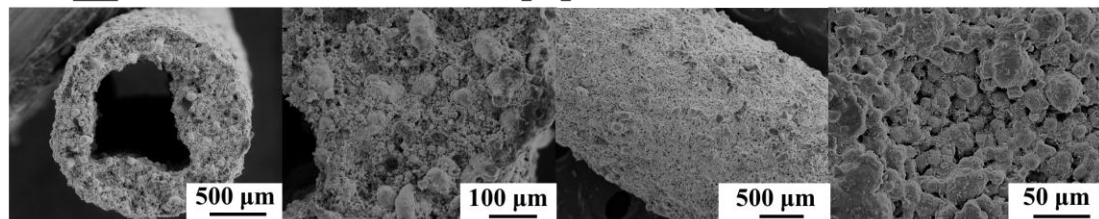
- SS<sub>10/44</sub> sintered 90 min at 900°C in N<sub>2</sub>:H<sub>2</sub> 15%



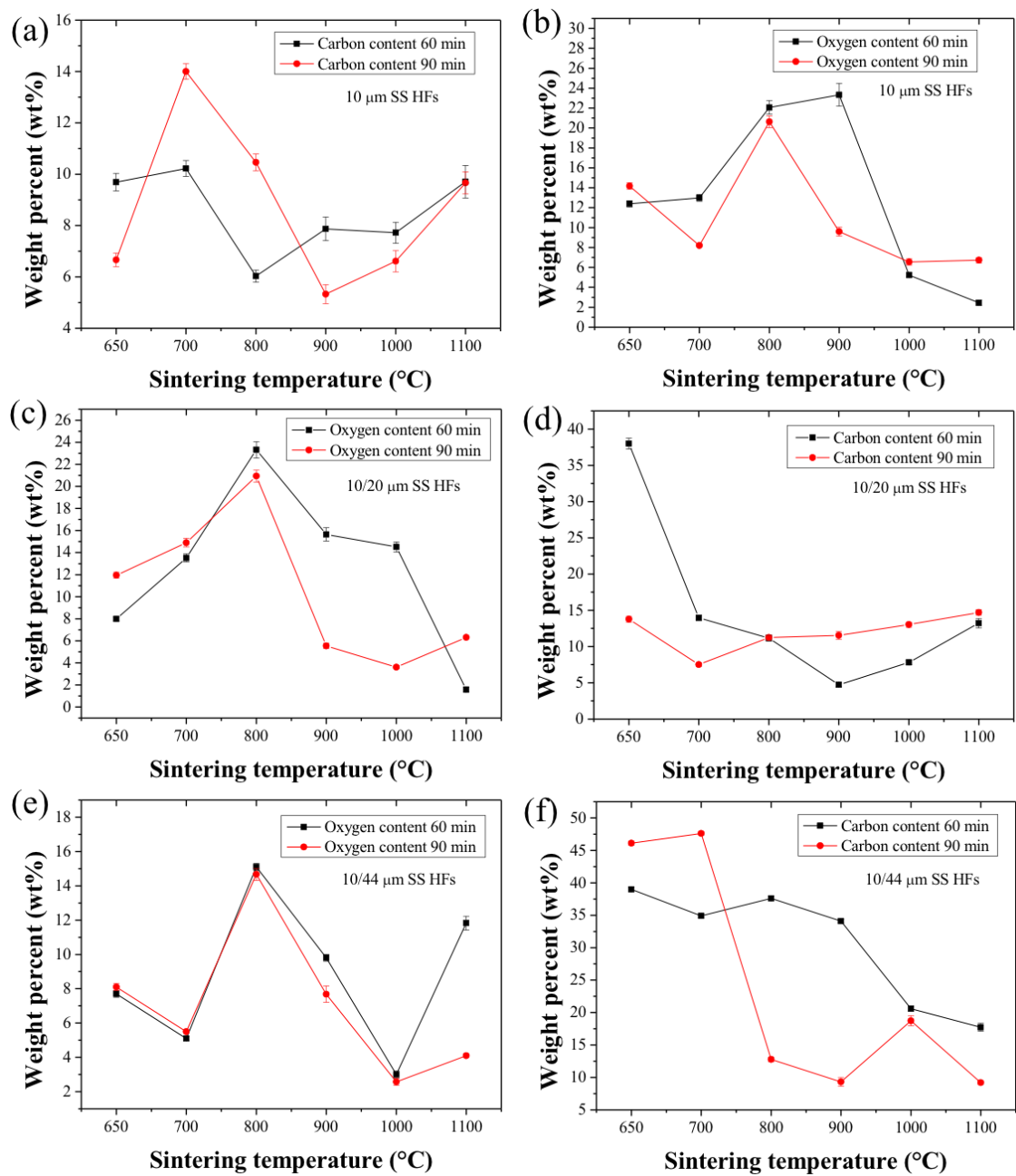
- SS<sub>10/44</sub> sintered 90 min at 1000°C in N<sub>2</sub>:H<sub>2</sub> 15%



- SS<sub>10/44</sub> sintered 90 min at 1100°C in N<sub>2</sub>:H<sub>2</sub> 15%

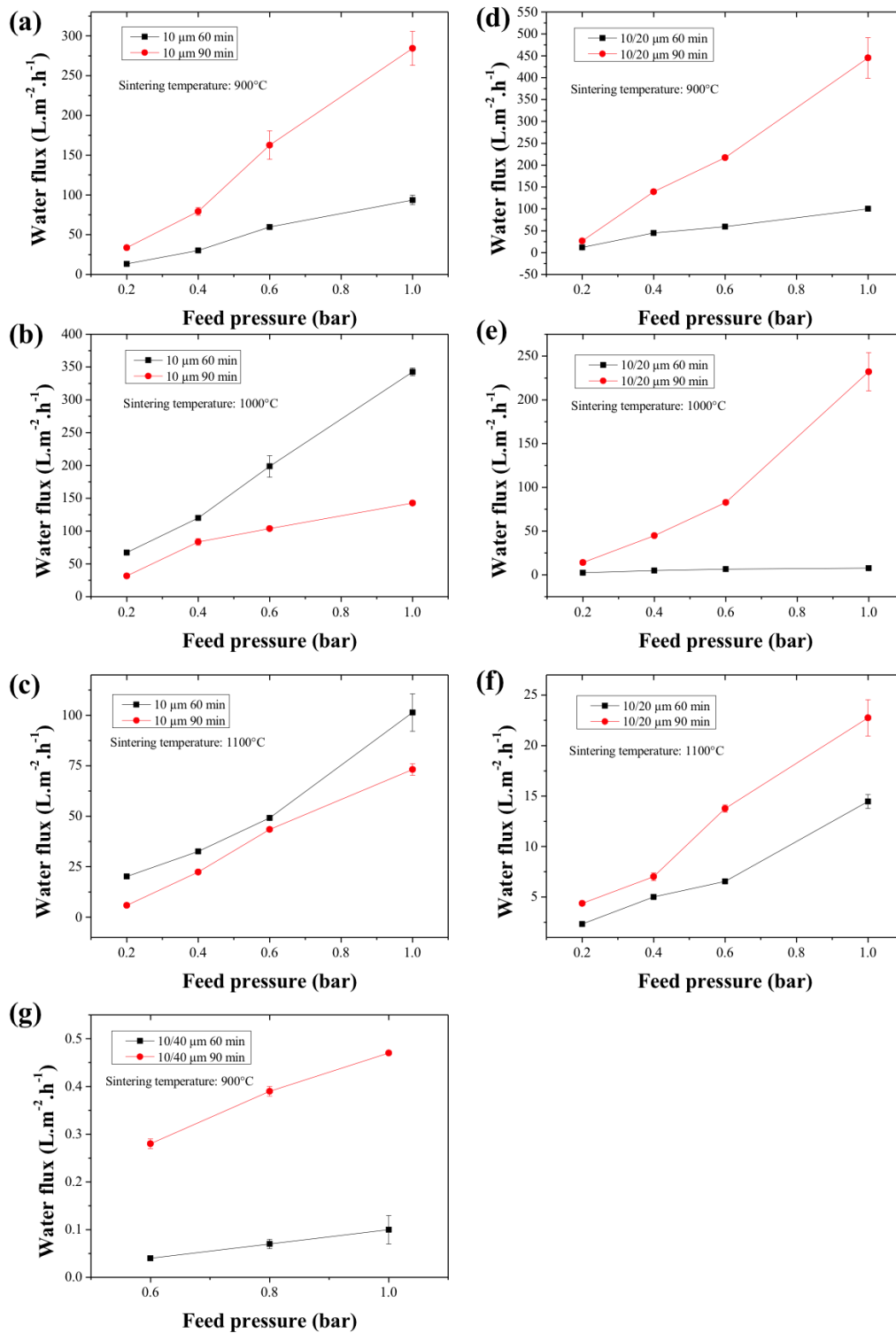


**Figure S4.** SEM images of the green and sintered SS<sub>10/44</sub> HF's at temperature ranging from 650 to 1100 °C for 60 or 90 min.



**Figure S5.** Carbon and oxygen elemental analysis of the SS<sub>10</sub> HFs (a,d), SS<sub>10/20</sub> HFs (b,e) and SS<sub>10/44</sub> HFs (c,f).





**Figure S6.** Pure water fluxes as a function of the feed pressure: (a), (b) and (c): SS<sub>10</sub> HF; (d), (e) and (f): SS<sub>10/20</sub> HF; g: SS<sub>10/44</sub> HF.