Hydrogen Driven Cage Unzipping of C_{60} into Nano-Graphenes.

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1. Deconvolution of IR spectra of samples produced by hydrogen treatment of C_{60}

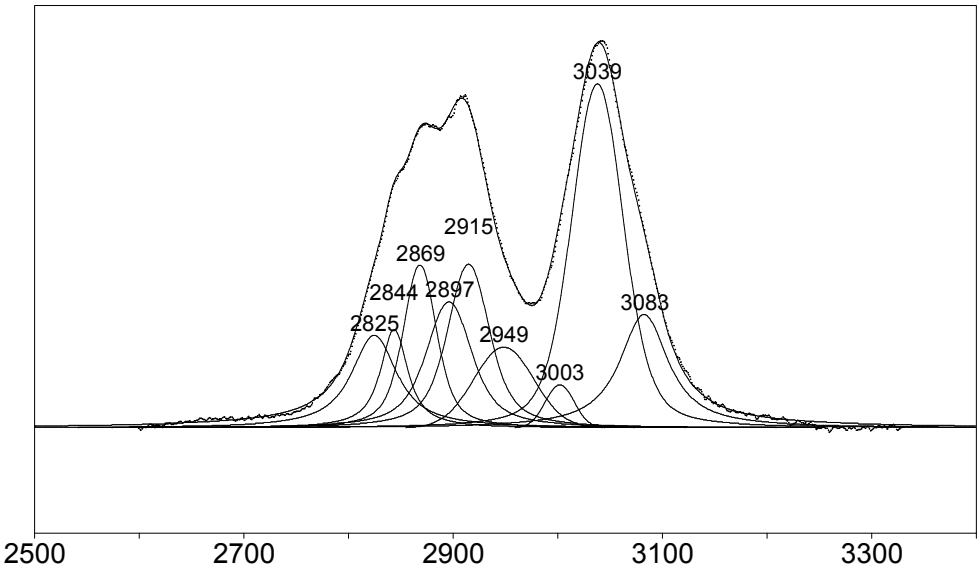

Figure 1S a Deconvolution of IR spectra recorded from sample produced by hydrogen treatment of C_{60} at 550^0C for 18 hours.

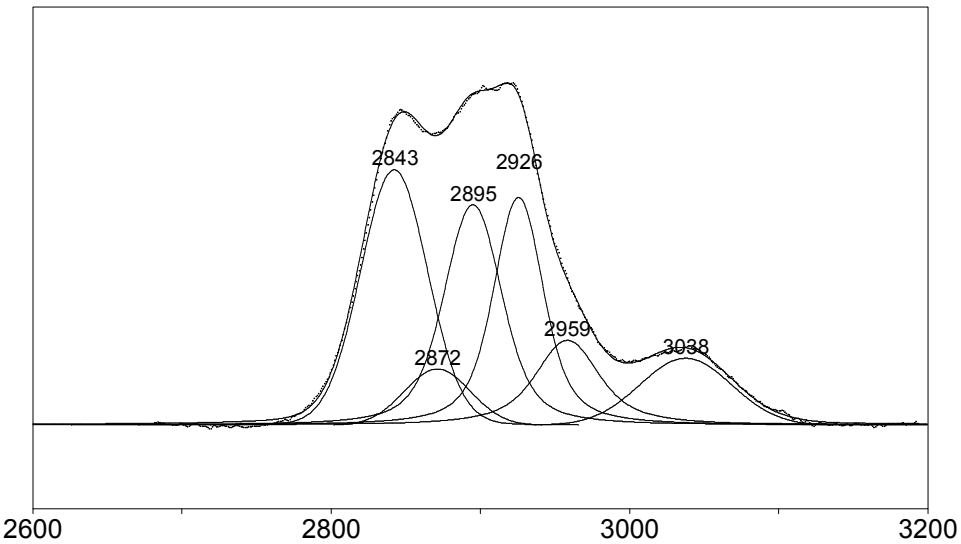

Figure 1S b Deconvolution of IR spectrum recorded from sample produced by hydrogen treatment of C_{60} at 500^0C for 72 hours.

Hydrogenated. 450^0C 72h (mostly $C_{60}H_x$)	Hydrogensated. 550^0C 18h
	2825
2843	2844
2872	2869
2895	2897

2926	2915
2959	2949
	3003
3038 (weak)	3039 (strongest)
	3083

Table 1S Peak positions (region of C-H vibrations) from samples shown in Figures 1 a and b compared to peak positions of partly fragmented $C_{60}H_x$

(1) Talyzin, A. V.; Tsybin, Y. O.; Purcell, J. M.; Schaub, T. M.; Shulga, Y. M.; Noreus, D.; Sato, T.; Dzwilewski, A.; Sundqvist, B.; Marshall, A. G. *J Phys Chem A* **2006**, *110*, 8528.

Hydrogen. t=6h	Hydrogen. t=9h	Hydrogen. t=12h	Hydrogen. t=18h	$C_{60}Hx$ (hydrogen content ~5.3wt.%)[1]	Benzo[*k*] Fluoranthene >0.2 relative intensity
662			660		
705	703	702	702		
	715	715			
757	751	747	749	751	743.6, 745.9

					773
				810	
820	820	820	823		823
843	841	841	841	837	
871	873	874	875	866	883
		951			
977	977	979	967		
1013	1020	1020	1010		
1045	1045	1050	1043		
1087	1072	1075		1179	
			1091		
	1131	1133	1130	1123	
1142					
	1151	1151	1151		
	1181	1178			
	1231	1229	1235		
			1252		
1252	1254	1255	1267		1247
				1274	
	1319	1318			
1342	1343				
		1354			
	1365			1369	
		1373	1383		
1389	1393	1394	1409		
					1429
1440	1441	1441	1437	1444	
		1457	1456		1451
	1478	1478	1478		
					1489.7
		1521			
	1548	1550	1558		

1605	1611	1608	1606		
1655	1659	1660	1658		
		1719	1720		
2801	2804			2826	
	2856	2859	2858	2858	
2865					
	2887				
		2897	2898		
				2909	
2925	2929	2924	2925		
				2946	
2955	2956	2956	2955		
				3020	
				3044	3069

(1) Talyzin, A. V.; Tsybin, Y. O.; Purcell, J. M.; Schaub, T. M.; Shulga, Y. M.; Noreus, D.; Sato, T.; Dzwilewski, A.; Sundqvist, B.; Marshall, A. G. *J Phys Chem A* **2006**, *110*, 8528.

Table 2S. peak positions found in IR spectra of dried DMF extracts from samples obtained by hydrogen annealing of C60 for various periods of time at 500^0C.

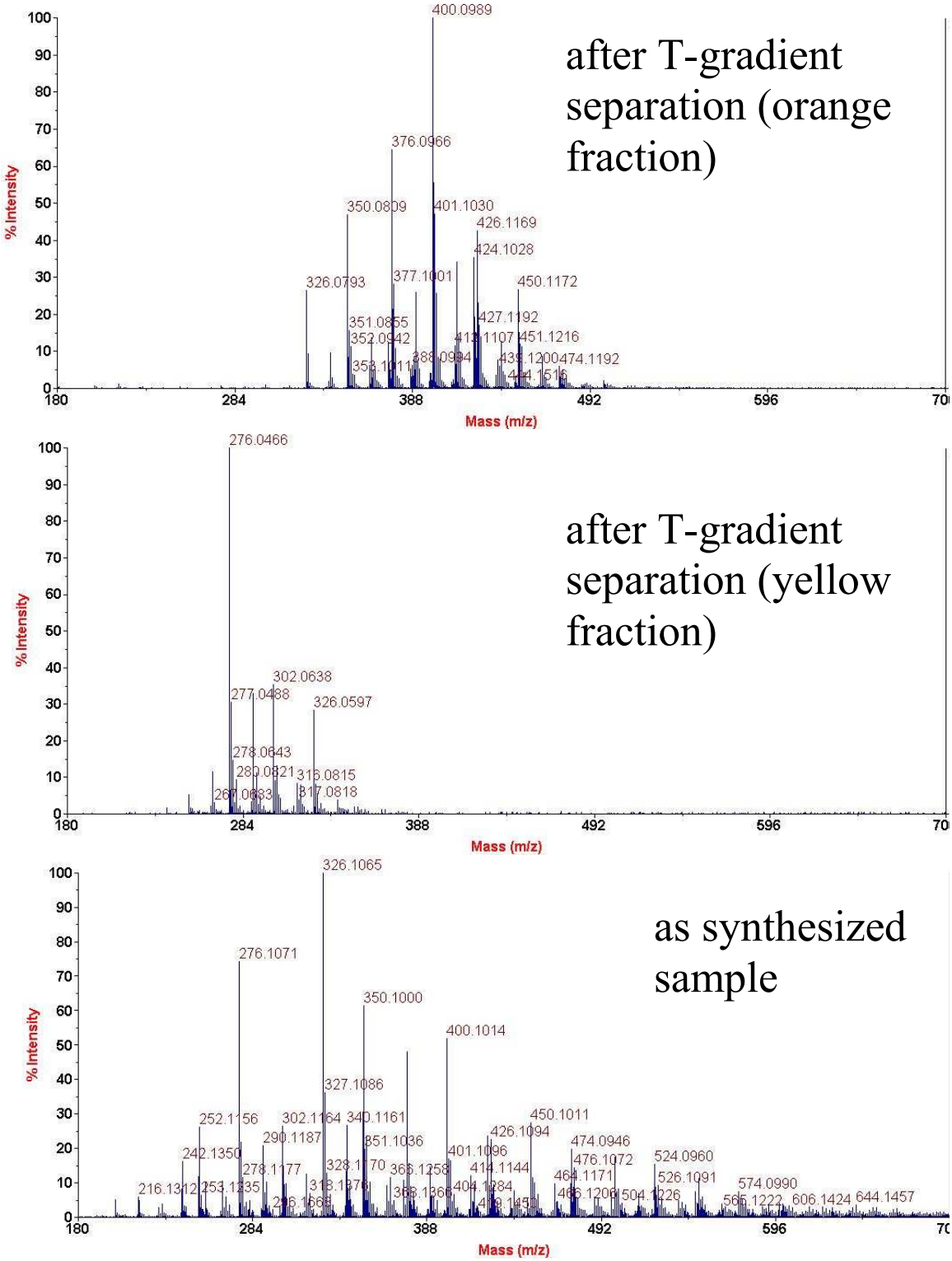

Figure 2S MALDI TOF spectra recorded from soluble part of hydrogen collapsed sample: bottom panel shows spectra of pristine sample and top panels show spectra recorded from yellow (lighter) and orange fractions precipitated using sublimation of powder with

temperature gradient inside of vacuum sealed glass tube. As expected, the two fractions are represented by heavier and lighter molecules.

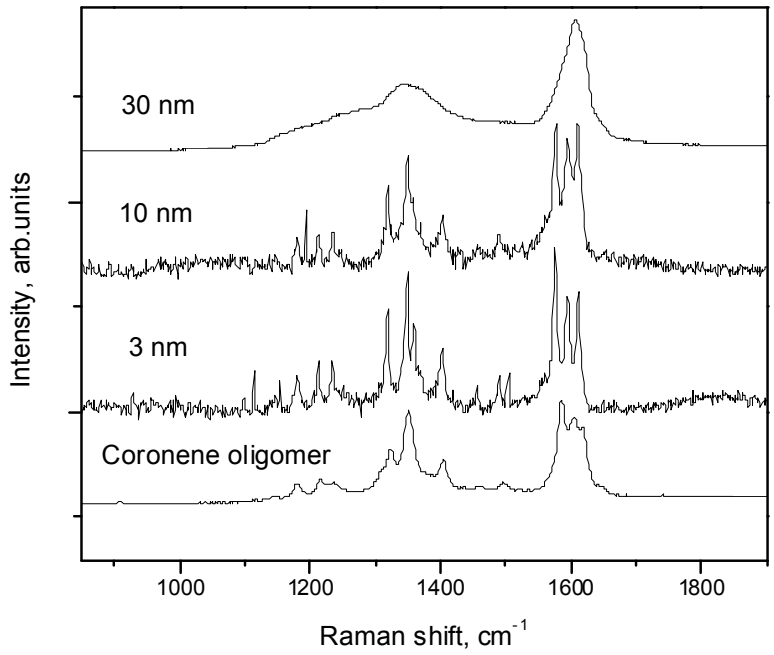

Figure 3S. Raman spectra recorded from C_{60} films of various initial thickness subjected to hydrogen annealing at 550°C. This figure is similar to Figure 9 in the main text but performed with second set of C_{60} films and hydrogenation treatments. This set of experiments was performed in order to verify reproducibility of observed hydrogen driven C_{60} thin film reactions. The thickness of very thin films is approximate as it was estimated from duration of C_{60} evaporation.