SUPPLEMENTARY INFORMATION

S.I. 1 - Effect of grinding on graphite particles by SEM images

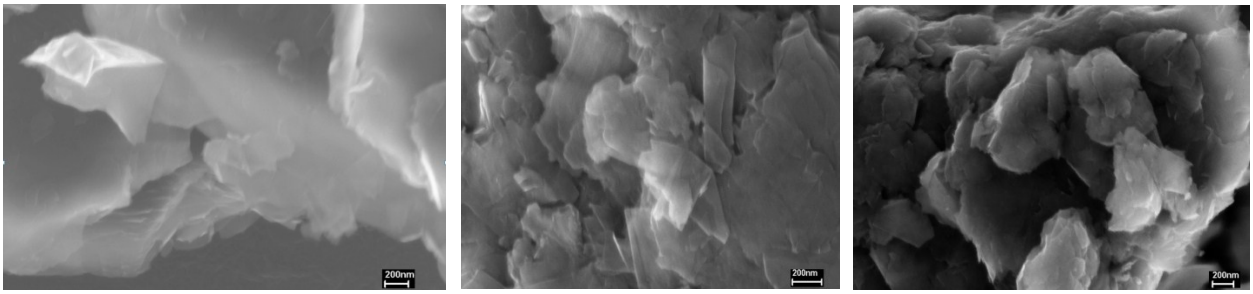

Figure S1: SEM images showing the changes in the dimensions of graphite platelets upon ball-milling. Pristine graphite (left), G5h (center) and G20h (right). The unit of length shown is 200 nm. For images with different zoom refer to[1].

S.I. 2 - ***Formation of the DMPO-OOH adduct in solution: cw-ESR spectrum***.

Figure S2 shows the spectrum of the DMPO-OOH adduct isolated from the early cw-ESR spectrum obtained approximately 2 minutes after mixing of G20h and DTT with a buffered DMPO solution. At the beginning, the intensity of the DMPO-OOH is comparable with that of DMPO-OH and of the nitroxide (RNO), whereas at later time it is relatively much weaker. It becomes thus possible to carry out a weighted difference of the two spectra, thus removing the contribution of the DMPO-OH and that of the nitroxide RNO from the spectrum recorded at early times. The difference spectrum is shown in Figure S2. The relative simulation (red trace) is obtained by using the parameters from the literature[2] and fits nicely the lineshape of the spectrum, giving the unequivocally assignment of the spectrum to the DMPO-OOH adduct.

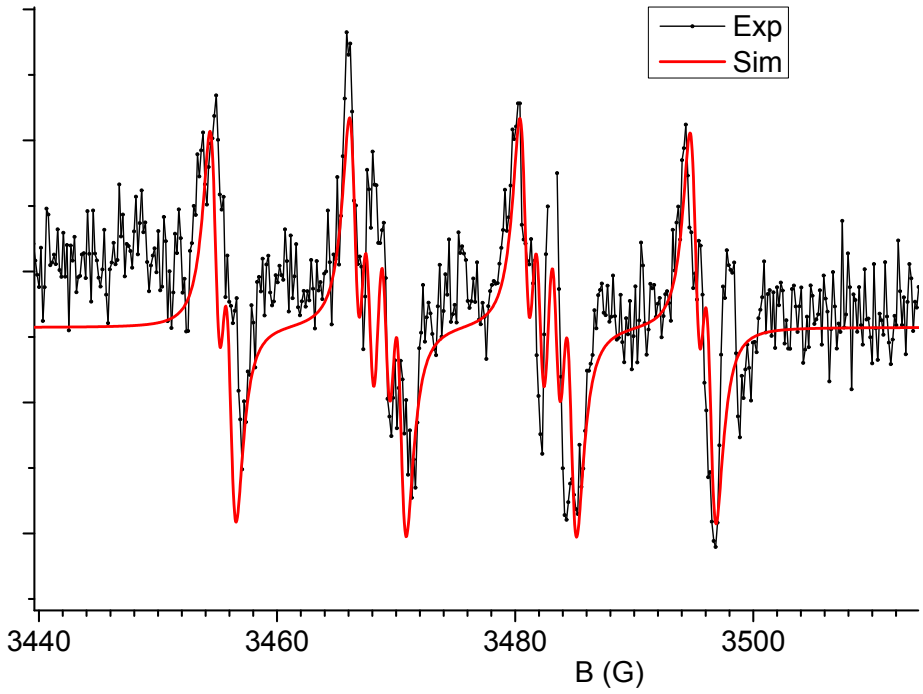

Figure S2 : typical cw-EPR spectrum of the DMPO adducts obtained in solution after 15 min of reaction. In red the simulation of the spectrum of the DMPO-OOH adduct using literature data (aN = 14.2 G, aHβ = 11.4 G, and aHγ = 1.2 G).

The simulation of the EPR spectra of DMPO spin adducts produced inside cells and shown in Fig. 9 are reported in Fig. S3. The spectrum was obtained as superposition of three species:

i) the DMPO-OH adduct, showing a four-line EPR signal with g = 2.0057 and hyperfine coupling constants aN=14.9 G, aHβ=14.7 G

ii) the nitroxide adduct (RNO), already observed in cell-free solution experiments (three strong lines, aN=14.8 G; aHβ=0.9(2H) G).

iii) a third DMPO adduct with aN=15.7 G; aH=22.8 G which can be assigned to carbon based radicals (DMPO-R species) 3.

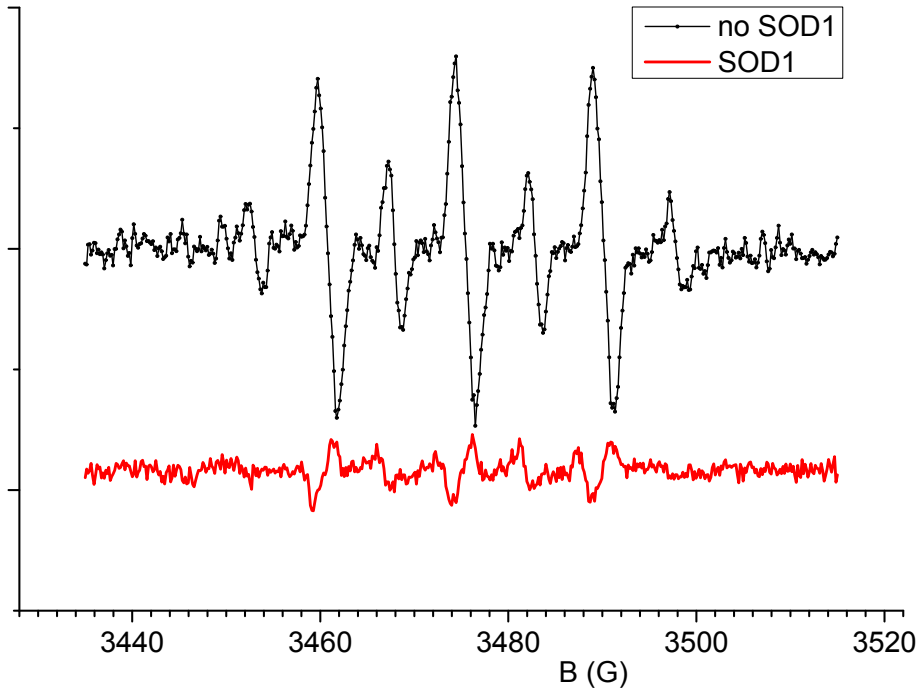

Figure S3: effect of addition of SOD1 at room temperature to the solution containing G20h and DTT at pH=7. In figure the cw-EPR spectra are reported the difference of the cw-EPR spectra acquired 3 min after the preparation of the solution and that acquired 30 min later. In black (top) the spectrum-difference of the solution without SOD1, in red (bottom) with the addition of SOD1 (28 nM).

Fig. S3 shows the growth of the EPR signal half an hour after the preparation of the solution. In this time, almost 90 % of the maximum intensity of the DMPO-OH signal is expected to be reached (see Figure 5 in the main text). The absolute signal growth was estimated as difference between the spectrum taken 3 min after the preparation of the solution, and that taken 30 minutes later.
The figure evidences that addition of SOD1 is responsible of an almost complete quenching of the signal growth of the DMPO-OH signal.

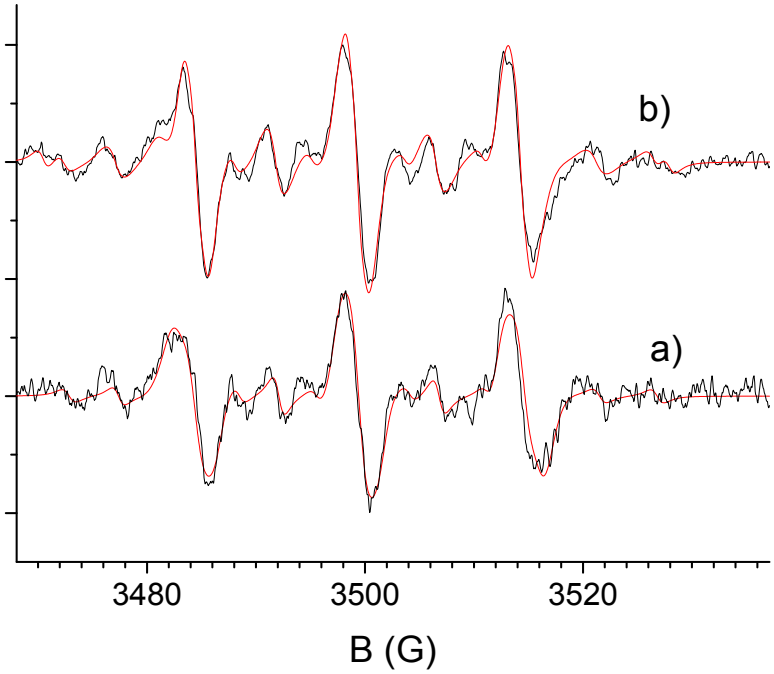

Figure S4: cw-EPR normalized spectra at room temperature of the spin adducts obtained by reaction of DMPO in BEAS cells in the absence (a) and in the presence (b) of G20h particles. In red the relative simulations.

Table S1: Relative content of species RNO, DMPO-OH and DMPO-R (referred to RNO, taken as 1) for samples cell/DMPO and cell/DMPO/G20h.

	RNO	DMPOOH	DMPOR
cells/DMPO	1	0.13	0.13
cells/DMPO/G20h	1	0.19	0.18

S.I. 3 - Absorption measurements in cells

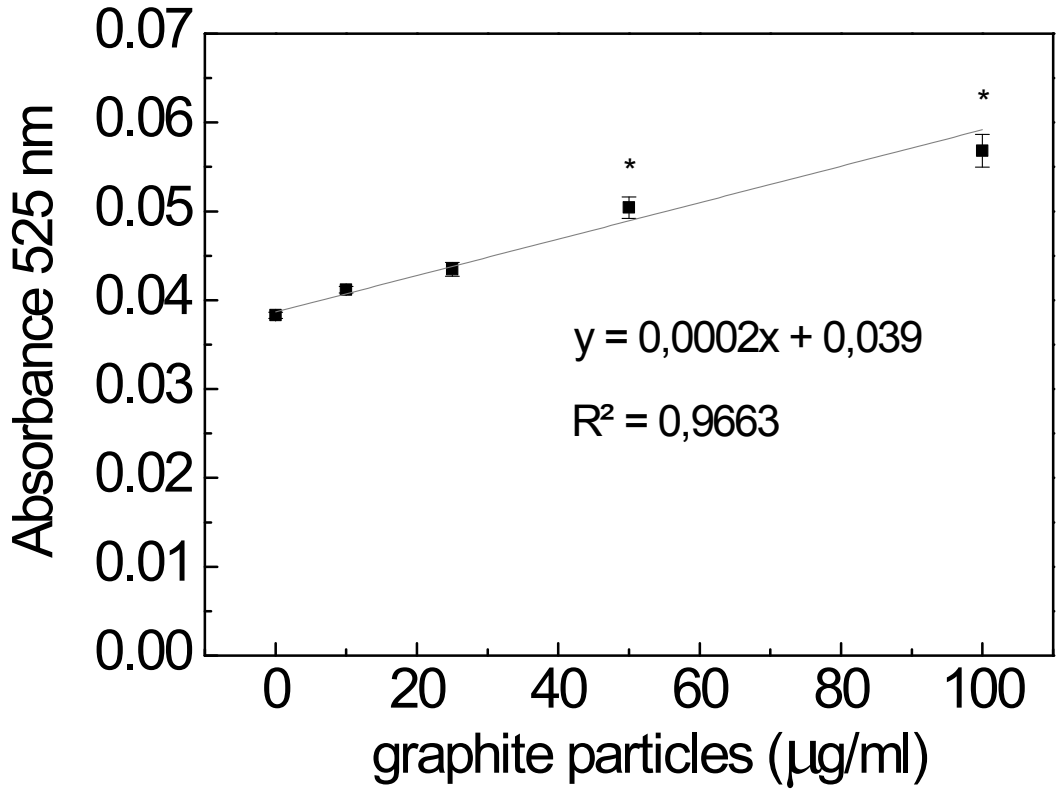

Figure S5: Absorbance (Abs) at 525 nm (emission wavelength used for carboxy-H_2DCFDA) of cells exposed to increasing doses (0, 10, 25, 50, 75, 100 µg/ml) of G20h particles. The absorbance was measured in order to determine the self-absorption affecting the emission intensity. An increased absorbance of G20h at increasing concentration of particles was confirmed. Data are shown as means ± SE of at least three different experiments. *Statistically significant difference from untreated cells, ANOVA + Dunn's post hoc test, $p < 0,05$.

References

1 M. Tommasini, C. Castiglioni, G. Zerbi, A. Barbon and M. Brustolon, *Chem. Phys. Lett.*, 2011, **516**, 220–224.

2 E. Finkelstein, G. M. Rosen, E. J. Rauckman and J. Paxton, *Mol. Pharmacol.*, 1979, **16**.

3 G. R. Buettner, *Free Radic. Biol. Med.*, 1987, **3**, 259–303.