

## Supplementary information

### Thermoelectric and power generation of 2D structured pieces of graphene-nanodiamonds nanocomposite

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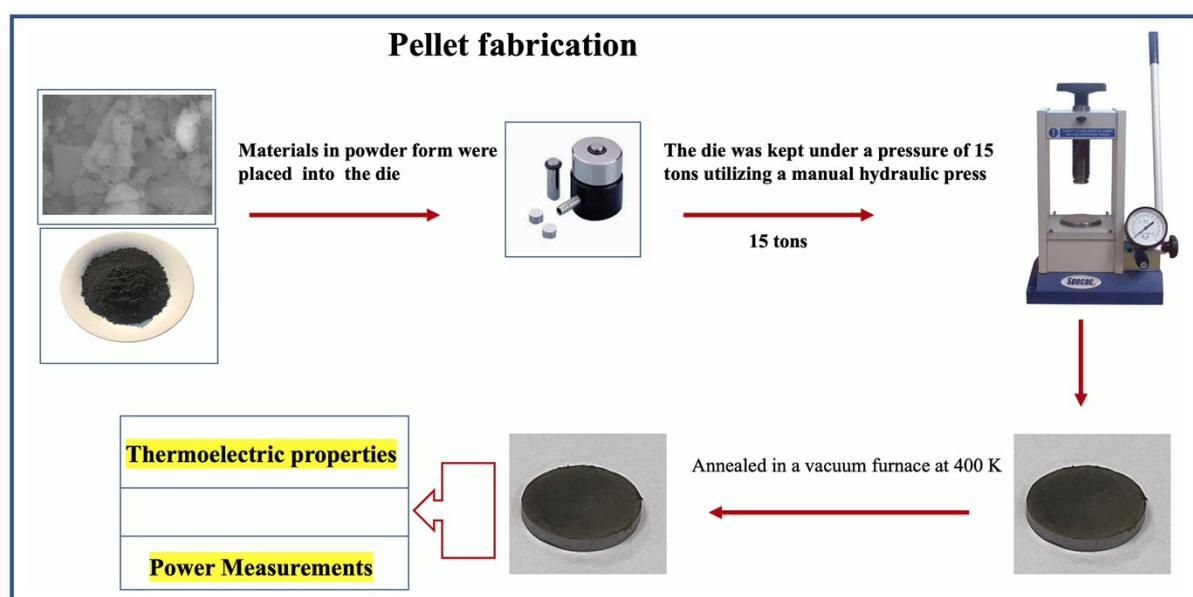
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The new nanocomposite of Gr-NDs structure was synthesized via the microwave chemical-assisted method using a microwave digester (Milestone, Italy), as reported by (Alsulami et al. 2022).

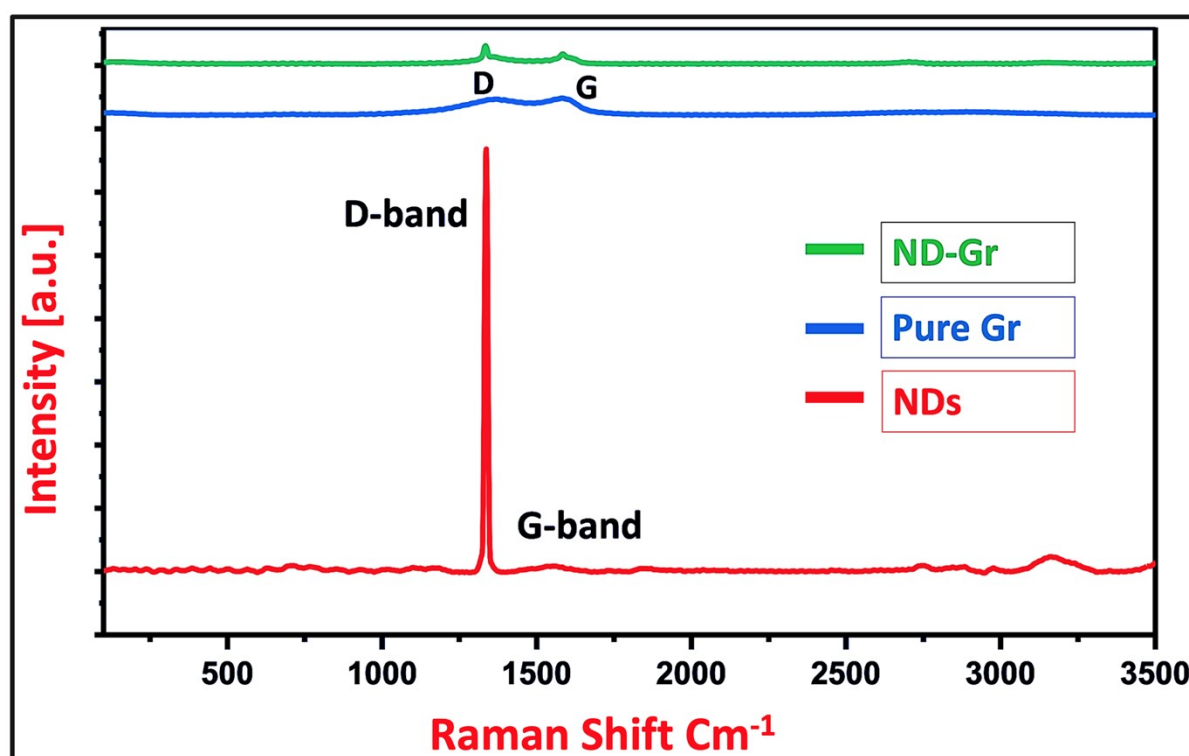
As shown in Figure S1, the formed pellets of 13 mm diameter and 2 mm thickness and the rectangular-shaped legs were fabricated using a hydraulic press machine by applying around 15 tons to produce highly dense pellets. The ratios of Gr and NDs were 95 and 5 %, respectively in the fabricated Gr-NDs nanocomposites.



**Figure S1.** Show the method used to fabricate the pellets.

The structure of the created nanocomposite carbon material was examined using Raman spectroscopy (Figure S2). Before processing at the microwave for comparison, Raman spectra for the final nanocomposite, as well as Gr-rec and NDs-rec samples, were taken using a 532 nm excitation laser (Figure S2). As can be seen, the D band and G-band are two distinct peaks in the NDs-rec sample itself. The spectra exhibit a diamond-specific distinct, sharp peak at 1333  $\text{cm}^{-1}$ . The G-band with graphitic content is related to the other broadband at 1555  $\text{cm}^{-1}$ . The Raman spectra of the Gr-rec sample are also depicted in Figure S2, and it includes two

main peaks that are located at 1367 and 1581  $\text{cm}^{-1}$ , respectively and correspond to the D-bands and G-band. The Raman spectra of nanocomposite material, however, revealed two peaks at 1333 and 1583  $\text{cm}^{-1}$  after processing that can be attributed to the signal of diamond in addition to the D-band and G-band of graphene. It's also important to notice that the processed NDs-Gr sample's D-band and G-band positions remained unchanged. However, compared to the Gr-rec sample, the D-band peak's sharpness, and intensity both increased. This might be because some NDs particles were present around the graphene sheets. (Alsulami et al. 2022).



**Figure. S2.** Raman spectra of NDs-rec, Gr-rec, and the Gr-NDs nanocomposite formed under microwave irradiation.

## References:

I. K. Alsulami, A. Saeed, S. Abdullahi, A. Alshahrie and N. Salah, *FlatChem*, 2022, **36**, 100432.