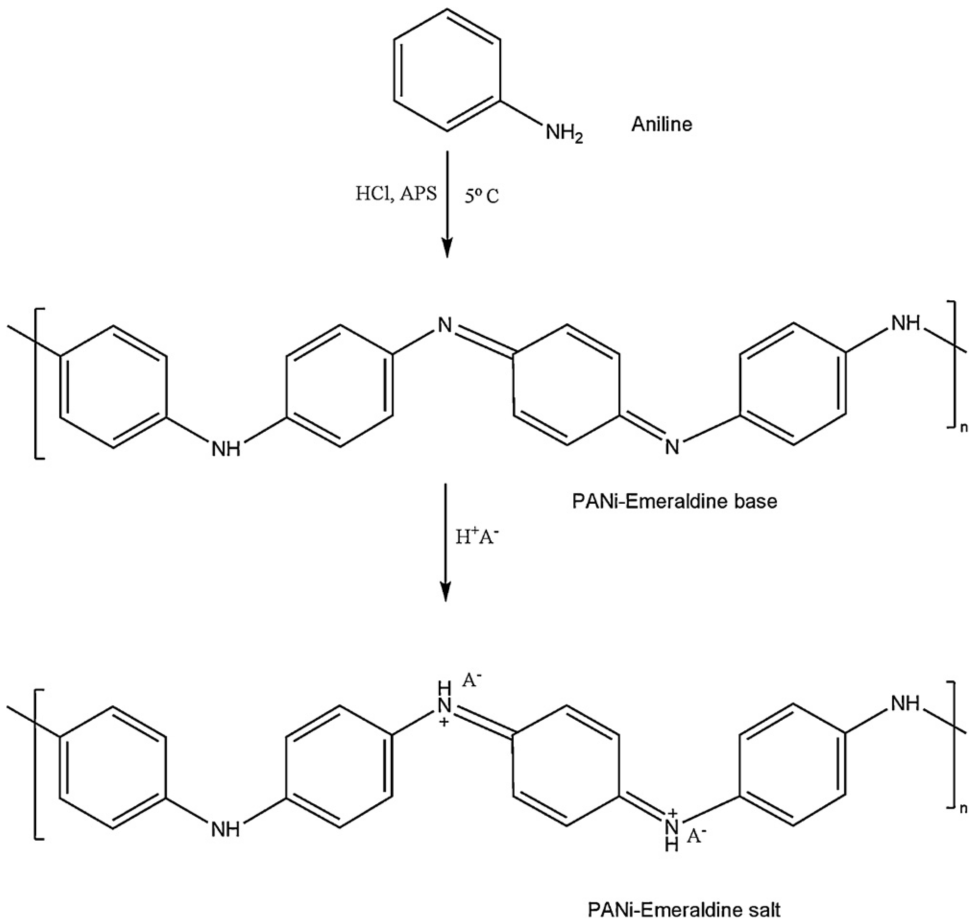

Fig. 4. Reaction scheme for aniline polymerization and doping with the formation of semi conducting emeraldine base and conducting emeraldine salt forms.

hexachloroplatinic acid solution. As the curve of the phase transferred ion did not show any additional peak at 310 nm, it confirmed the complete transfer to the organic layer and absence of any trace of water–toluene interface. This is in support to the observation of clear solution as the lower layer in Fig. 1b.

Formation of PANi from aniline and doping of one of its form (emeraldine base) with acid is shown in the reaction scheme (Fig. 4). When cation like Pt(IV) is added to the emeraldine base form of PANi, it shows ionic interaction with the cation. Subsequent reduction of Pt(IV) to Pt by the reducing agent allows the dispersion of Pt on PANi matrix. This principle has been used in this study to prepare Pt/PANi composite.

The X-ray diffraction patterns for PANi and Pt/PANi are given in Fig. 5. The XRD pattern of PANi (Fig. 5a) exhibits a semi crystalline structure. It shows a broad peak at $2\theta = 25.5^\circ$ corresponding to the (1 1 0) lattice plane [35–37]. The broad peak between $2\theta = 22^\circ$ and 28° is the characteristic of PANi [38]. The Pt/PANi composite (Fig. 5b) shows characteristic sharp peaks at $2\theta = 39.83^\circ$, 46.29° and 67.62° corresponding to the (1 1 1), (2 0 0) and (2 2 0) lattice planes [39] respectively of Pt (JCPDS file no. 04-0802), confirming the presence of Pt in the face-centred cubic (FCC) structure. While platinum retains its lattice form when dispersed in PANi matrix, there is change in the semi crystallinity of PANi. It is reasonable to believe that the small peaks at 31.78° and 33.77° are due to the changes in the crystalline structure of PANi due to the presence of Pt as they do not match with the characteristic indices of platinum and the peaks fall in the amorphous range of PANi (Fig. 5a). The average size of the PANi and Pt in Pt/PANi composite has been determined by the Debye–Scherrer equation after curve fittings and background subtractions.

According to Debye–Scherrer method, the approximate crystallite size of powder sample (d) can be determined by the following equation:

$$d = \frac{0.9\lambda}{\beta \cos\theta}$$

where λ is the wavelength of the X-ray radiation (0.154056 nm for Cu Kα), β is the full width at half maximum (FWHM) of the diffraction peak measured at 2θ (in radians), and θ is the Bragg's diffraction angle in degrees.

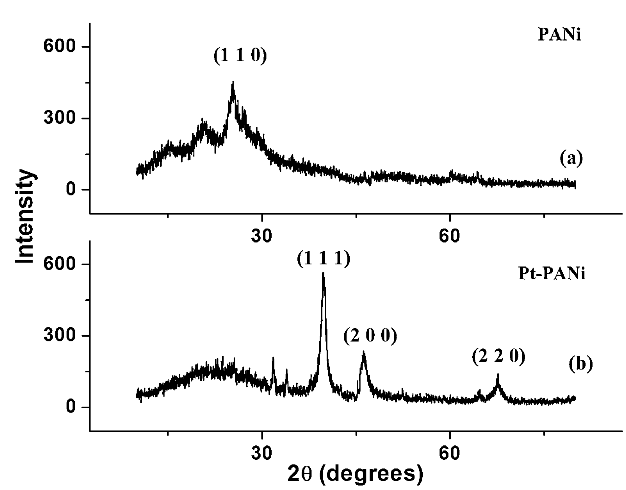

Fig. 5. XRD patterns of (a) PANi and (b) Pt–PANi composite.