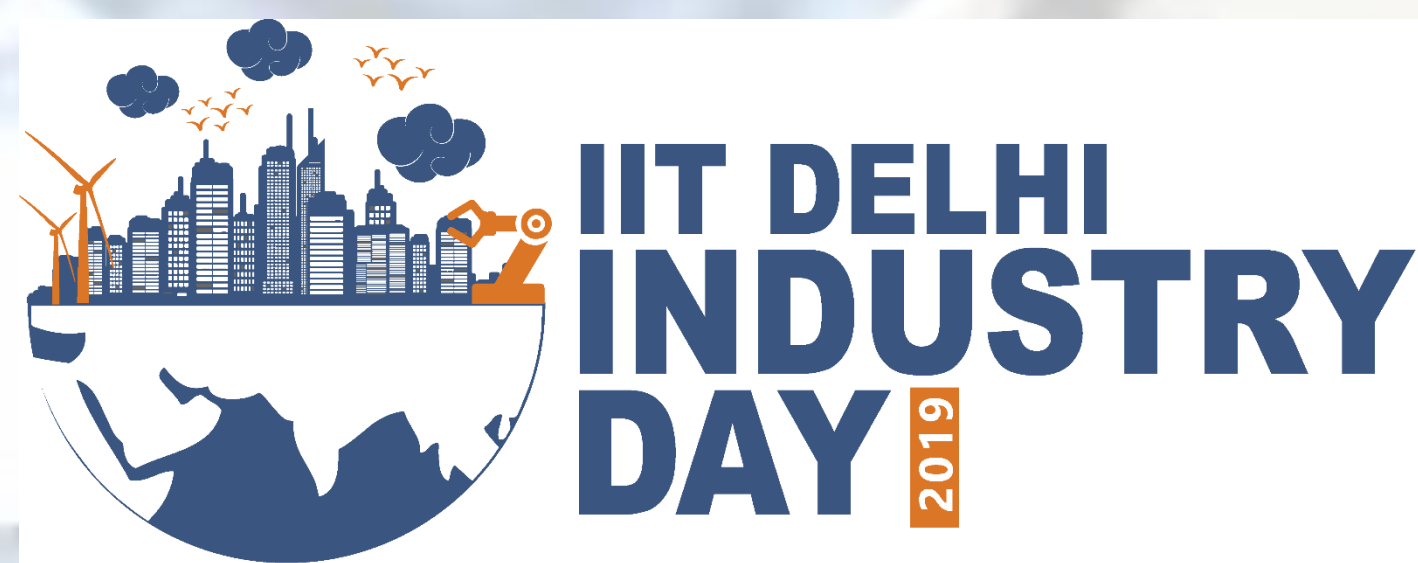


Theme # Emerging Nano and Advanced Materials

Controlling Barrier Properties of Composites

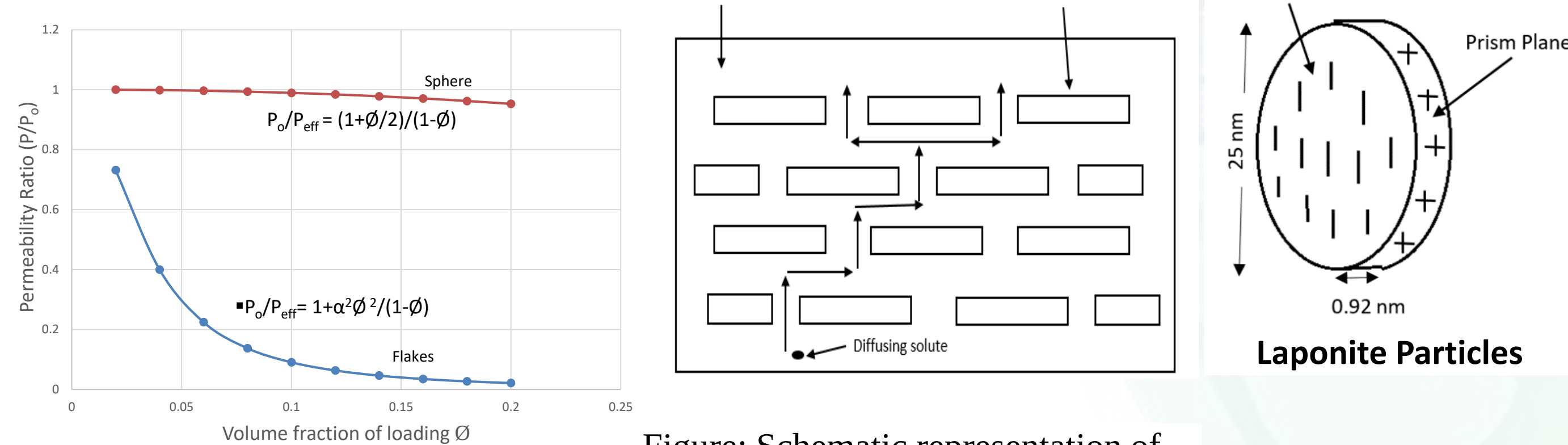
Abbas Asad, Singh Vikram*



Abstract

The objective of this work is to develop barrier membranes with controlled alignment of disc shaped nanoparticles within the polymer matrix using magnetic field. The aim is to get controlled diffusivity of the membranes, where the controlled diffusivity would depend upon the loading, aspect ratio and orientation of the particles within the membranes.

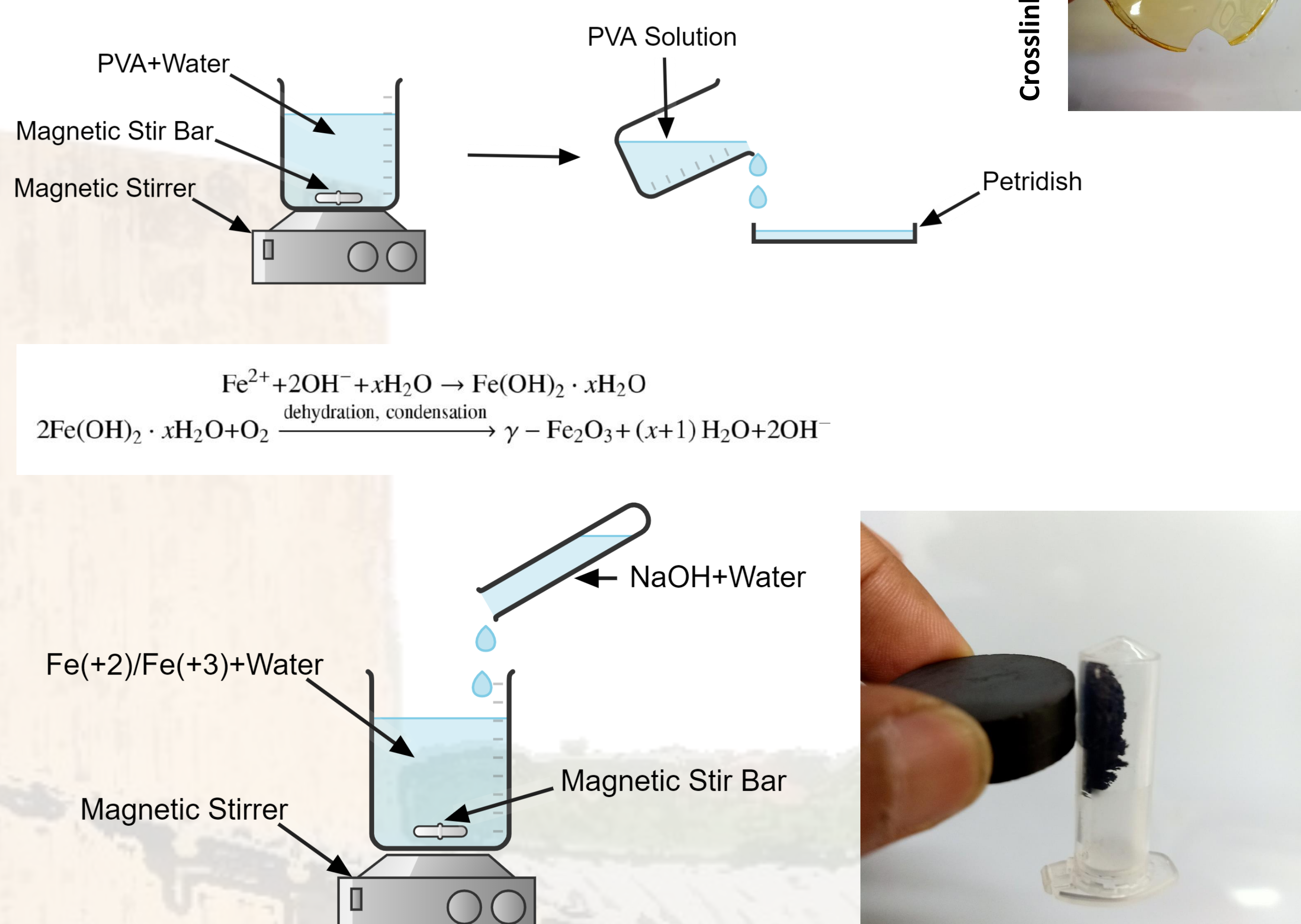
Introduction



Comparison of spherical and non-spherical particles as barriers.

Figure: Schematic representation of diffusion through a composite media containing impermeable particles.

Materials and Methods



Result

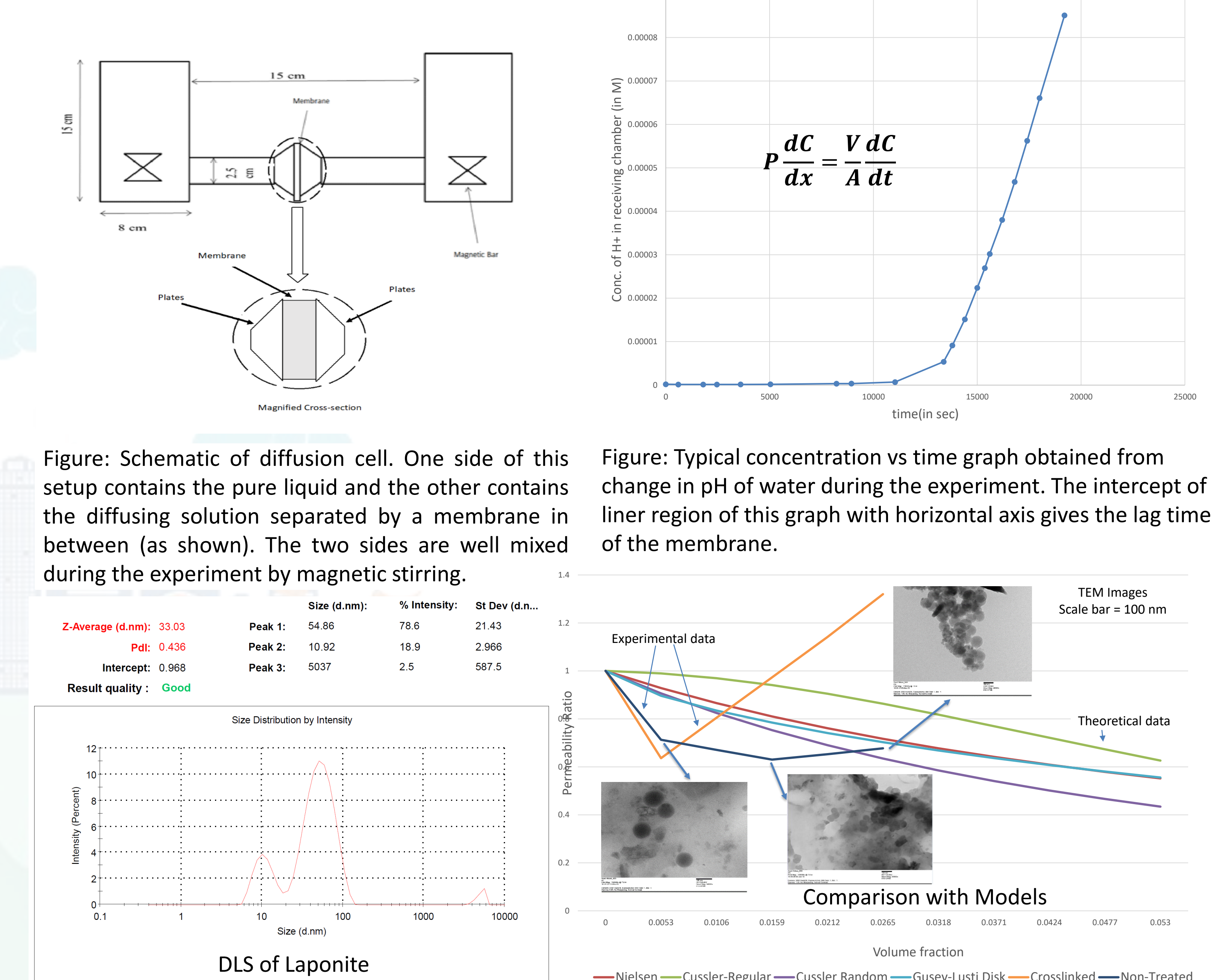
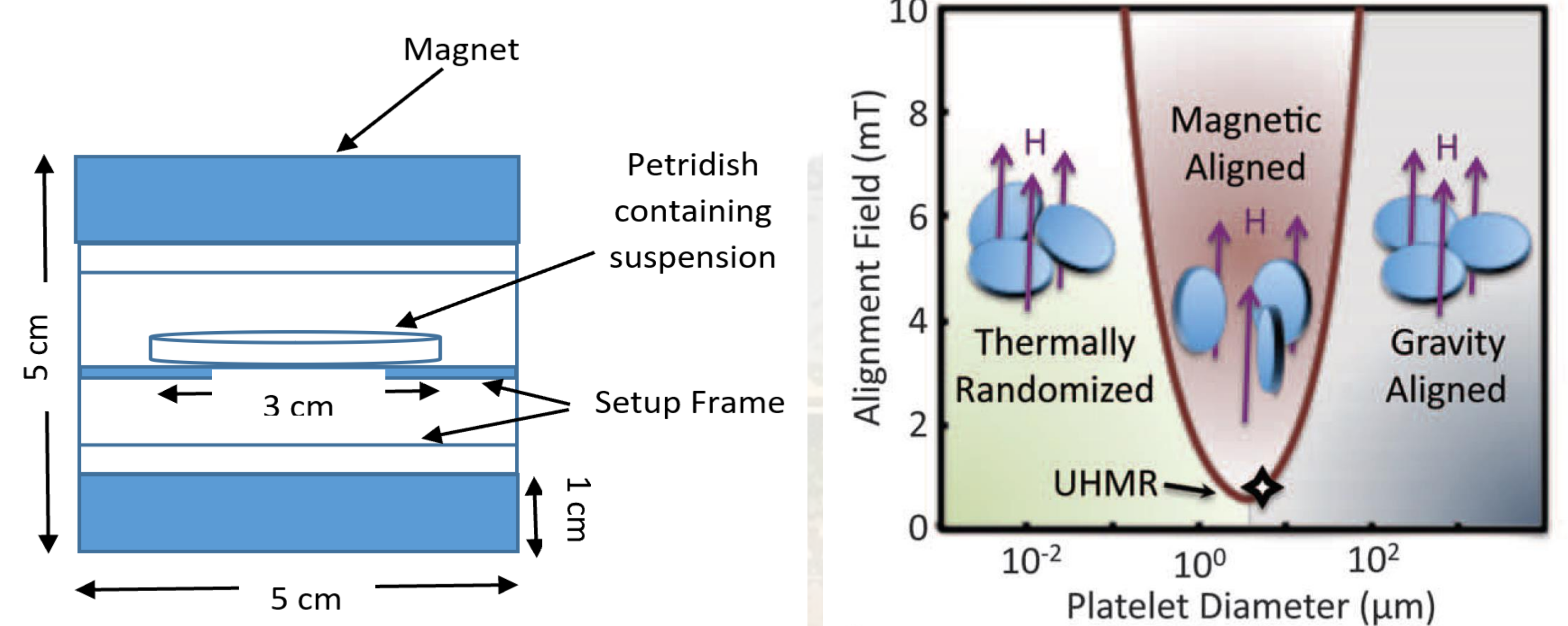


Figure: Schematic of diffusion cell. One side of this setup contains the pure liquid and the other contains the diffusing solution separated by a membrane in between (as shown). The two sides are well mixed during the experiment by magnetic stirring.

Figure: Typical concentration vs time graph obtained from change in pH of water during the experiment. The intercept of liner region of this graph with horizontal axis gives the lag time of the membrane.

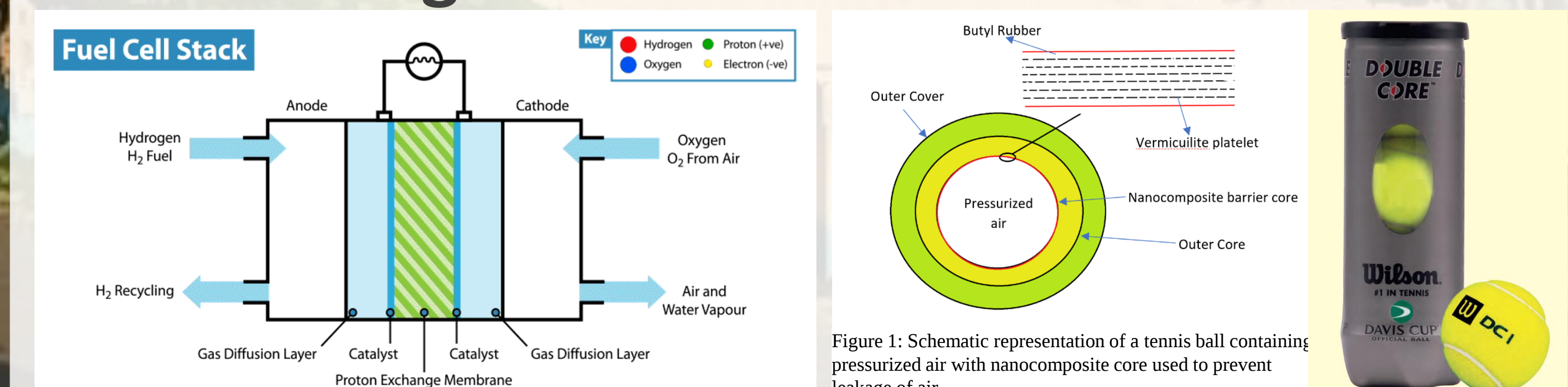
Sample	Permeability Values ($10^{-11} \text{ m}^2/\text{sec}$)					Average Permeability ($10^{-11} \text{ m}^2/\text{sec}$)
	Sample1	Sample2	Sample3	Sample4	Sample5	
Pure PVA	8.146	9.47	8.851	8.553	8.655	8.735
PVA-Laponite (1%)	5.906	5.26	5.93	5.295	5.397	5.557
PVA-Laponite (3%)	14.6	9.27	11.5	11.5	10.8	11.534



Conclusions and Future Work

- The experiments shows variation of diffusivity in membrane with loading.
- Magnetic alignment of clay particles in composites is to be done by coating the particles with superparamagnetic materials.

Industrial Significance



References

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- [2] J. P. DeRocher, B. T. Gettelfinger, J. Wang, E. E. Nuxoll, and E. L. Cussler, "Barrier membranes with different sizes of aligned flakes," *J. Memb. Sci.*, vol. 254, no. 1–2, pp. 21–30, 2005.

Acknowledgement

I would like to acknowledge my supervisor Dr. Vikram Singh for his guidance and MTP-BTP students for their help during sample testing .