

From operating heavy duty electric machines to application of magnetic particles inside living cells/cell-spheres.

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Abstract: Heavy Duty industrial applications imposing high demands on the productivity of machines. Living cells are efficient organic heavy duty systems with no down time. 3D cell spheres might be closer to reality than 2D cell meadows.

I. INTRODUCTION

Industrial heavy duty machines have not much in common with living human cells. Cell membranes can handle higher electric field strength than these machines (Fig.1).

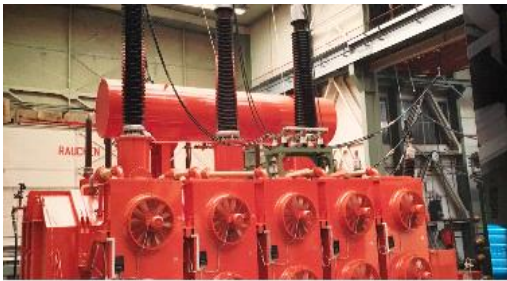


Figure 1. 500 MVA transformer 132kV/400kV with on-load taps changer-
The bushings(black) extend over 2m to hold a voltage of 132kV.

A voltage (Action potential) of 100 mV across a cell membrane of 10 nm thickness means, that a living cell restrains an electric field of 10×10^6 V/m, 3 fold higher compared to the transformer in (Fig.1).

II. METHODS

A power station generator operates with a multi- phase voltage of about 10 kV. The hereto belonging grid transformer elevates this voltage up to above 100 kV. Inside these machines a dynamic magnetic [1] field (Tesla values) is working. We copy this technique and energize cell internalized iron oxide particles with a dynamic field.

The 100nm large magnetic particles are brought inside living cell-spheres (Fig.2) and make the spheres move due to a dynamic magnetic field. There is no noticeable increase in particle temperature.

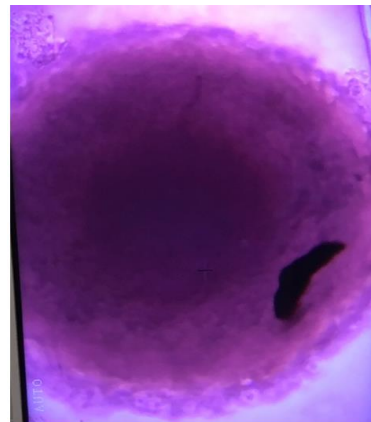


Figure 2. 100nm iron oxide particles inside a cell sphere are energized by a magnetic field and make the sphere non-invasively move as a whole.

III. DISCUSSION

Dynamically powered iron oxide particles can permeabilize the lysosome membrane and enable aggressive lysosome enzymes to enter the cytosol and then the cell surrounding [2], however inserted into 3 D cell-spheres (Fig.2) they can move the whole conglomerate non-invasively, without any noticeable wear or increase in temperature.

REFERENCES

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- [2] E.Zhang, M.F. Kircher, M.Koch, L.Eliassen, S.N. Goldberg, E.Renstroem, "Dynamic Magnetic Fields Remote-Control Apoptosis via Nanoparticle Rotation", ACS Nano, 2014, pp.3192-3201

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