**Business trip: March 28&29, 2016**

**National Magnetics Group, Inc**

**NMG. TCI Ceramics**

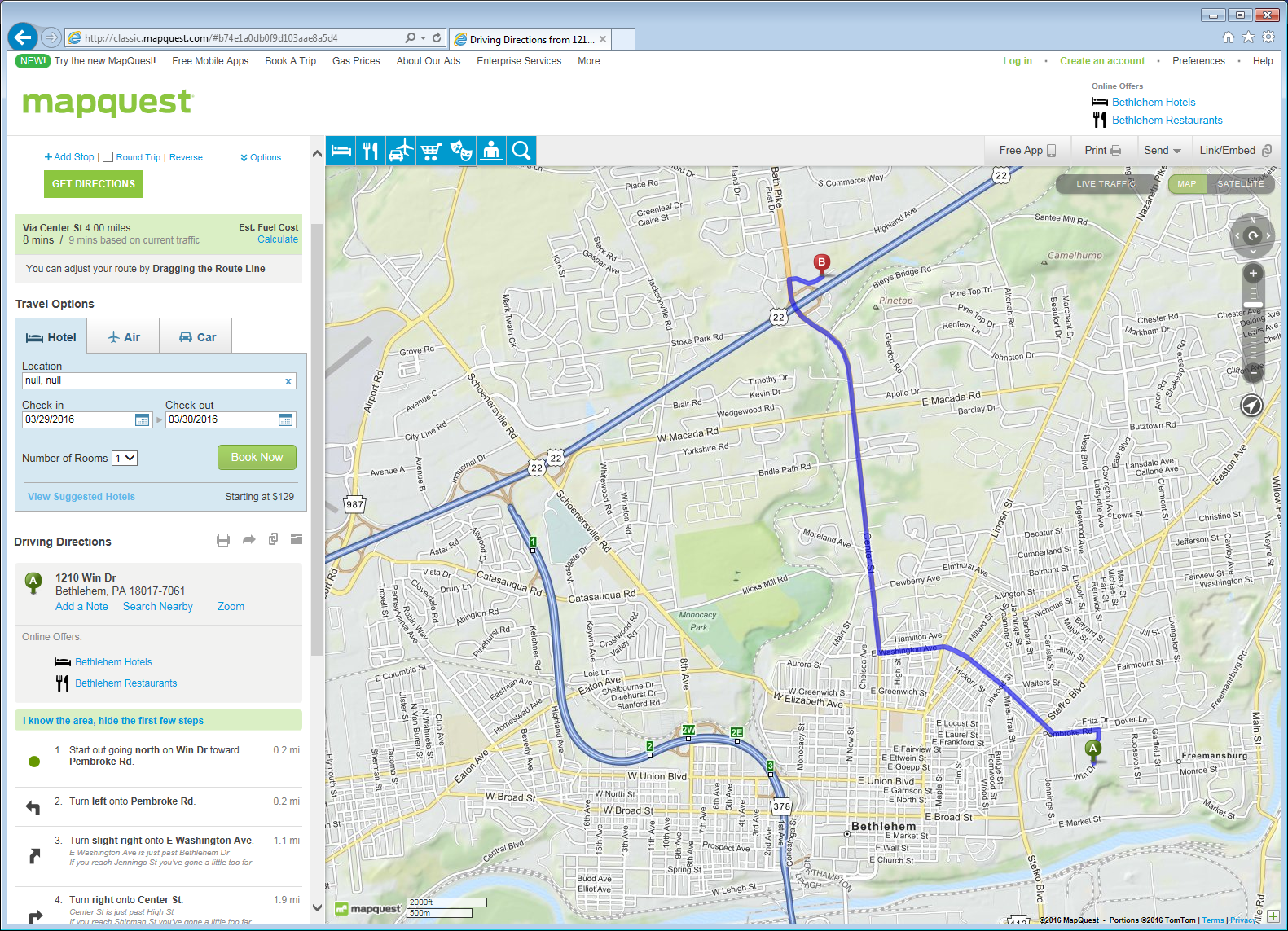
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To see & to ask:

1. How mixes are made? How stoichiometry is controlled? How the uniformity of the mix is controlled?
2. Preparation for heat processing? What is the time of firing?
3. What is the furnace size and what is the temperature uniformity in the furnace?
4. What is the surface quality after thing are taken from the furnace?
5. How the uniformity of the properties is tested after firing? (if tested)
6. What machinery and tools are used for mechanical work? What is surface quality after machining?
7. What glue is used to make big assemblies? Is there any non-glue (e.g. paste) solution to use during assembly (e.g. for heat removal purpose)?
8. What are major factors that define parameters of the garnet?
9. What properties of the material are measured and how?

**Meeting March 29, 2016**

Paul Oberbeck – the owner (president)

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Also presented several people that were responsible for different processes.

Talked with Ashim Samanta - overview of the processes at NMG. He promised to send his presentation file, but what I’ve got is just the titles.

Production line:

* Raw materials
* Milling
* Mixing
* Why the doping material are needed – to reduce the Ms and to change the Curie temperature.
* Drying
* Carbonizing
* Pressing and firing
* Critical steps to achieve needed properties (includes permeability, saturation magnetization, Curie temperature, thermal coefficients of permeability)
* Different processes to get the final shape (spherical powder)
* Hydrostatic pressure
* High temperature kilns
* Pressurized kiln is too small to process all the sectors for one garnet block.
* One layer layout for our work
* Mechanical shaping – very knowledgeable/enthusiastic manager
* Possible issues with the proposed way of handling the assembly 🡪 **Suggestion to make it simpler – to glue in the shop**.
* Inspection of the line width of a resonance (ΔH) at 9.4 GHz
* Setup to measure the dielectric properties: ε and tg(δ) (in a cavity)
* Setup to measure hysteresis curves of the ferrite materials
* **agreement to measure magnetization curve of the garnet**.
* Trans-Tech flyer about the measurements of the permeability tensor.

Take a closer look:

* Nickel ferrites: NF 5000 🡪 NF5200 (4πMs = 5000 Oe 🡪 5200 Oe)
* Magnesium ferrites may provide some advantages
* M-20 material μ = 2000 and stable with T
* M3F (20) – tuner of the 10st harmonics cavity
* Alternatives for the Al garnet that reduce ΔH
* Dielectrics with different permittivity and temperature compensation !!