

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

R.J. REYNOLDS VAPOR COMPANY,

Petitioner

v.

FONTEM HOLDINGS 1 B.V.,

Patent Owner

Case IPR2016-01268

Patent 8,365,742

SUPPLEMENTAL DECLARATION OF DR. ROBERT H. STURGES

R.J. Reynolds Vapor

1. I have been retained by the law firm of Brinks Gilson & Lione on behalf of R.J. Reynolds Vapor Company (“Petitioner”) in connection with IPR2016-01268. I previously provided a declaration (Ex. 1015) concerning the technical subject matter relevant to the petition in IPR2016-01268 (“Petition Declaration”).

2. My background and qualification are contained in my Petition Declaration.

3. Besides the information listed in ¶ 8 of my Petition Declaration, I have also considered Patent Owner's Objections to Petitioner's Evidence (Paper 16).

4. In ¶ 45 of my Petition Declaration, I explained and opined that: More specifically, the porous body 27 is attached to the atomization cavity wall 25. The PHOSITA would have recognized that the porous body is attached to the cavity wall 25 via either a friction fit or through a bonding material to prevent axial displacement of the porous body under the shear forces exerted at the interface of cavity wall 25 with the porous body 27 when the porous body is inserted into the storage porous body 28. The shear forces could be particularly significant when the porous body and the solution storage body 28 are made from materials that have similar and relatively high rigidity. *See* Ex. 1003 at 9-10 (noting that porous body 27

may be made from “nickel, stainless steel fiber felt, high molecule polymer foam and foam ceramic,” and that solution storage body 28 “can be filled with polypropylene fiber, terylene fiber, nylon fiber, or be filled with plastic that are shaped by foaming, such as polyamine resin foam column or polypropylene foam column; alternatively, it may be made of a column formed by molding polyvinyl chloride, polypropylene, polycarbonate into a stack of laminated layers.”). Ex. 1015 at ¶ 45.

In the Petition Declaration, I also opined that “[t]he PHOSITA would have recognized that the foregoing materials can have a wide range of rigidities.” *Id.*

5. The PHOSITA would have recognized the foregoing because rigidities of materials were well known in the art and published in a variety of resources. For example, one reliable resource that would have been available to a PHOSITA with respect to the rigidity of polymer foams is the Cambridge University Engineering Department's Materials Data Book, the 2003 Edition (“Materials Data Book 2003”). True and correct copies of the particularly relevant pages from the Materials Data Book 2003 are attached as Ex. A. The rigidity of a material is defined by the Shear Modulus, G , which in turn relates to the Young's modulus, E , by the formula $G = E/2(1+\nu)$ where ν is the Poisson's ratio. As a PHOSITA would have recognized, Poisson's ratio is the ratio of transverse contraction strain to longitudinal extension strain in the direction of stretching

force ($\nu = -(\text{lateral strain})/(\text{longitudinal strain})$). Thus, rigidity generally increases with the material's Young's modulus, E. Materials Data Book 2003 at p. 4. The Young's Modulus, E, of selected materials is listed in the Materials Data Book. *Id.* at p. 11. As noted below, for a given material the E value (and thus rigidity) can vary, as shown in the following chart:

		E (GPa)	
Polymers ¹	Elastomer	Butyl Rubber	0.001 - 0.002
		EVA	0.01 - 0.04
		Isoprene (IR)	0.0014 - 0.004
		Natural Rubber (NR)	0.0015 - 0.0025
		Neoprene (CR)	0.0007 - 0.002
		Polyurethane Elastomers (elPU)	0.002 - 0.003
		Silicone Elastomers	0.005 - 0.02
	Thermoplastic	ABS	1.1 - 2.9
		Cellulose Polymers (CA)	1.6 - 2
		Ionomer (I)	0.2 - 0.424
		Nylons (PA)	2.62 - 3.2
		Polycarbonate (PC)	2 - 2.44
		PEEK	3.5 - 4.2
		Polyethylene (PE)	0.621 - 0.896
		PET	2.76 - 4.14
		Acrylic (PMMA)	2.24 - 3.8
		Acetal (POM)	2.5 - 5
		Polypropylene (PP)	0.896 - 1.55
		Polystyrene (PS)	2.28 - 3.34
		Polyurethane Thermoplastics (tpPU)	1.31 - 2.07
		PVC	2.14 - 4.14
		Thermoset	Teflon (PTFE)
	Epoxies		2.35 - 3.075
	Phenolics		2.76 - 4.83
	Polyester		2.07 - 4.41
	Polymer Foams	Flexible Polymer Foam (VLD)	0.0003 - 0.001
		Flexible Polymer Foam (LD)	0.001 - 0.003
Flexible Polymer Foam (MD)		0.004 - 0.012	
Rigid Polymer Foam (LD)		0.023 - 0.08	
Rigid Polymer Foam (MD)		0.08 - 0.2	
Rigid Polymer Foam (HD)		0.2 - 0.48	

Id.

6. The units for values of E are given in GPa (gigapascal) in the chart above. It is readily apparent that range of values of E for the polymer foams in the chart above is over 1,000:1. Since the rigidity of a material G is defined as $G = E/2(1+\nu)$ and ν (*i.e.*, the material's Poisson ratio) can vary depending on the microscopic structure of the material, the range of rigidity of polymer foams is even wider than 1,000:1 shown in the chart above.

7. Another reliable resource that would have been available to a PHOSITA with respect to the rigidity of polymer foams is Ashby, *Materials Selection in Mechanical Design*, Pergamon Press, 1992 ("Ashby"). True and correct copies of the particularly relevant pages from the Ashby book are attached as Ex. B. The rigidity of a material is defined by the Shear Modulus, G, which in turn relates to the Young's Modulus, E, approximately represented as $G \approx 3E/8$. Ashby at pp. 27-29. The Young's Modulus and specific modulus of various materials are shown in the Ashby book, which are copied below. *Id.* at p. 28.

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