UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ASML NETHERLANDS B.V., EXCELITAS TECHNOLOGIES CORP., AND QIOPTIQ PHOTONICS GMBH & CO. KG,
Petitioners

v.

ENERGETIQ TECHNOLOGY, INC.,
Patent Owner

Cases IPR2015-01300 and IPR2015-01303
U.S. Patent No. 7,435,982

DECLARATION OF DONALD K. SMITH, PH.D.

I, Donald K. Smith, Ph.D., hereby declare as follows:

I. INTRODUCTION

1. I am the President of Energetiq Technology, Inc. ("Energetiq"), which has its principal place of business at 7 Constitution Way, Woburn, MA 01801. I have worked at Energetiq in this capacity since 2004.

2. I am a named inventor on United States Patent Nos. 8,525,138 (the "'138 patent"), 7,435,982 (the "'982 patent"), 8,309,943 (the "'943 patent") and 7,786,455 (the "'455 patent).

3. I submit this declaration in support of Energetiq's Patent Owner Response in connection with *inter partes* review proceedings IPR2015-01368, IPR2015-01277, IPR2015-01279, IPR2015-01300, IPR2015-01303, and IPR2015-01377. I have personal knowledge of the matters discussed below unless otherwise noted. If called upon as a witness, I could and would competently testify to the statements made herein.

4. I received my Bachelor of Science in Physics from Davidson College in 1975, my M.S. in in electrical engineering from the University of Wisconsin in 1976, and my Ph.D. in Electrical Engineering from the University of Wisconsin in 1980. I have authored more than ten publications in peer reviewed scientific journals and am an inventor on more than 40 United States Patents and additional related foreign patents in the fields of vacuum technology, instrumentation,

turbomolecular pumps, ion trap mass spectrometers, plasma sources for etching and deposition, plasma-based reactive gas sources (such as ozone generators, atomic fluorine generators and atomic oxygen sources), plasma-based light sources, plasma devices and plasma chemical vapor deposition reactors. I have more than 35 years of professional experience in research and development in the areas of plasma physics and power electronics. I have 12 years of experience with inductively driven pulsed plasma light sources for EUV and DUV applications and patents on these devices. I have more than 10 years of experience in the research, design and functionality of high brightness laser-driven light sources such as those at issue in this proceeding. My curriculum vitae is attached hereto as Exhibit 2026.

5. During my career spanning over 35 years, I have held many positions relating to plasma physics, including as a Research Scientist at the University of Wisconsin for one year and for 7 years at the MIT Plasma Fusion Center. In 1988, I co-founded and served on the board of directors and as Vice President of Advanced Technology for Applied Science and Technology, Inc., ASTEX, developing plasma devices and reactive gas generators for semiconductor processing and chemical vapor deposition of diamond. Many tens of thousands of the products developed by me and by my team at ASTEX have been and continue to be installed in semiconductor fabs worldwide. On the strength of these

products, ASTEX became a successful public company and was acquired by MKS Instruments in 2001. I served as Vice-president and Chief Technology Officer at MKS between 2000 and 2004, when my colleagues and I founded Energetiq Technology, Inc.

II. MATERIALS REVIEWED

6. In preparing this declaration, I reviewed and considered the materials listed in Appendix A to this declaration. In addition, I reviewed the petitions, institution decisions, and supporting affidavits of Dr. Eden for each *inter partes* review proceeding, i.e. numbers IPR2015-01368, IPR2015-01277, IPR2015-01279, IPR2015-01300, IPR2015-01303, and IPR2015-01377.

III. OVERVIEW OF ENERGETIQ AND ITS PATENTED TECHNOLOGY

7. Energetiq is a leading developer and manufacturer of ultra-bright broadband light sources that enable the manufacture and analysis of nano-scale structures and products. Energetiq's light source products are based on technology that generates high brightness light with high reliability, high stability, and long life, all in a compact package. Energetiq's light sources are used for analytical spectroscopy, microscopy, and sensing in the life-sciences; lithography, metrology, inspection and photoresist development in semiconductor manufacturing; and for a variety of applications where synchrotron radiation and traditional arc-lamps have commonly been used.

8. For at least a decade prior to the invention, semiconductor manufacturing equipment used xenon or mercury arc lamps to produce light for use in wafer inspection, metrology and lithography systems. These lamps included an anode and cathode to generate an electrical discharge to provide power to a gas to generate and sustain a plasma which emitted light—they did not use lasers. Yet, arc lamps suffered from a number of shortcomings, including instability of the arc, undesirably short time to failure, and limits on how bright they could get, which severely constrained the accuracy and efficiency of the semiconductor manufacturing equipment that used them. In particular, the spectral brightness of xenon and mercury arc lamps (ordinarily in the range of about 1 to 9 mW/mm^2-sr-nm) was limited by the maximum current density. (*See* M. W. P. Cann, *Light Sources in the 0.15-20-μ Spectral Range*, Vol. 8 No. 8 Applied Optics 1645, 1658, Fig. 9 (1969) (Ex. 2072); (Solarz at 1:34-43 (Ex. 2073).) If the current density was too high, it would melt the electrodes.

9. Thus, for many years, the necessary improvements in semiconductor manufacturing tools had to come through steady improvements in components other than the light source, such as in the optics for collecting the light and the sensors for detecting and measuring light, rather than from the ability to deliver more light into smaller places. However, over time, the semiconductor industry

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