

## Personal data

Name: Juan Carlos Serrano Ruiz

## Education

Degree in Chemistry, University of Granada, Spain, 1995-2000

Master Degree in Materials Science, University of de Alicante, Spain, 2001-2003

PhD in Catalysis and Materials Science, University of de Alicante, Spain, 2006

## Current Position

Senior Researcher, Abengoa Research, Abengoa, Seville (Spain)

## Area of expertise

Biofuels and biorefineries

Heterogeneous catalysis, catalytic conversion of biomass platform molecules

Hydrogen technologies

## Research experience

- Research assistant, Ministry of Education and Science, Department of analytical chemistry, University of Granada, Spain, 2000.
- Intercampus researcher, Spanish Agency for International Collaboration (AECI), Department of Organic Chemistry, University of Córdoba, Argentina, 2000.
- PhD researcher, Spanish Ministry of Science Fellowship, Department of Inorganic Chemistry, University of Alicante, Spain, 2001-2006. (Research stays: University Wisconsin Madison in 2002, and University of Poitiers in 2004).
- Postdoctoral researcher, Spanish Superior Research Council (CSIC), Madrid, Spain, 2007.
- Postdoctoral researcher MEC-FULBRIGHT Fellowship, Department of Chemical and Biological Engineering, University of Wisconsin, Madison (WI), USA, 2008-2010.
- Postdoctoral researcher, Department of Organic Chemistry, University of Córdoba, Spain, 2011-2012
- Senior researcher, Abengoa Research, Spain, Oct 2012-present

## Scientific Publications:

57 scientific publications in SCI international journals, including one in Science.

H index: 25.

Total citations: 2620 (source: google scholar).

1. J. Silvestre-Albero, Juan Carlos Serrano-Ruiz, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Modification of the catalytic behaviour of platinum by zinc in crotonaldehyde hydrogenation and iso-butane dehydrogenation, *Applied Catalysis A: General*, 292, 244-251, (2005).
2. Juan Carlos Serrano-Ruiz, J. Luetlich, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Effect of the support composition on the vapor-phase hydrogenation of crotonaldehyde over Pt/Ce<sub>x</sub>Zr<sub>1-x</sub>O<sub>2</sub> catalysts, *Journal of Catalysis*, 241, 45-55, (2006).
3. Juan Carlos Serrano-Ruiz, G. W. Huber, M. A. Sánchez-Castillo, J. A. Dumesic, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Effect of Sn addition to Pt/CeO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> and Pt/Al<sub>2</sub>O<sub>3</sub> catalysts: An XPS, 119Sn Mössbauer and microcalorimetry study, *Journal of Catalysis*, 241, 378-388, (2006).
4. Juan Carlos Serrano-Ruiz, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Bimetallic PtSn/C catalysts promoted by ceria: Application in the nonoxidative dehydrogenation of isobutane, *Journal of Catalysis*, 246, 158-165, (2007).
5. Juan Carlos Serrano-Ruiz, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso, D. Duprez. Pt-Sn catalysts supported on highly-dispersed ceria on carbon: Application to citral hydrogenation, *Journal of Molecular Catalysis A: Chemical*, 268, 227-234, (2007).
6. E. V. Ramos-Fernández, Juan Carlos Serrano-Ruiz, J. Silvestre-Albero, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. The effect of the cerium precursor and the carbon surface chemistry on the dispersion of ceria on activated carbon, *Journal of Materials Science*, 43, 1525-1531, (2008).

7. Juan Carlos Serrano-Ruiz, E. V. Ramos-Fernández, J. Silvestre-Albero, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Preparation and characterization of CeO<sub>2</sub> highly dispersed on activated carbon, *Materials Research Bulletin*, 43, 1850-1857, (2008).
8. Juan Carlos Serrano-Ruiz, A. López-Cudero, J. Solla-Gullón, A. Sepúlveda-Escribano, A. Aldaz, F. Rodríguez-Reinoso. Hydrogenation of  $\alpha,\beta$ -unsaturated aldehydes over polycrystalline, (111) and (100) preferentially oriented Pt nanoparticles supported on carbon, *Journal of Catalysis*, 253, 159-166, (2008).
9. J. Silvestre-Albero, Juan Carlos Serrano-Ruiz, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Zn-modified MCM-41 as support for Pt catalysts, *Applied Catalysis A: General*, 351, 16-23, (2008). [Top 25 Hottest articles in Applied Catalysis A Oct-Dic 2008.](#)
10. E. L. Kunkes, D. A. Simonetti, R. M. West, Juan Carlos Serrano-Ruiz, C. A. Gaertner, J. A. Dumesic. Catalytic conversion of biomass to monofunctional hydrocarbons and targeted liquid-fuel classes, *Science*, 322, 417-421 (2008). [Featured on RSC magazine Chemistry World.](#) [Featured on Science Daily magazine.](#) [Featured on "The Naked Scientist".](#) [Selected as one of the 30 biggest breakthroughs in Chemistry in 2008 by RSC magazine Chemistry World.](#)
11. E. L. Kunkes, D. A. Simonetti, R. M. West, Juan Carlos Serrano-Ruiz, C. A. Gaertner, J. A. Dumesic. Production of monofunctional hydrocarbons from biomass derived carbohydrates via catalytic conversion on carbon supported platinum-rhenium, *Preprints - American Chemical Society, Division of Petroleum Chemistry* 54(1), 35-38, (2009).
12. Juan Carlos Serrano-Ruiz, J. A. Dumesic. Catalytic Processing of Lactic Acid over Pt/Nb<sub>2</sub>O<sub>5</sub>, *ChemSusChem*, 2, 581-586, (2009).
13. C. A. Gaertner, Juan Carlos Serrano-Ruiz, D. J. Braden, J. A. Dumesic. Catalytic coupling of carboxylic acids by ketonization as a processing step in biomass conversion, *Journal of Catalysis*, 266, 71-78, (2009). [Top 25 Hottest articles in Journal of Catalysis Jul-Sept 2009.](#)
14. Juan Carlos Serrano-Ruiz, J. A. Dumesic. Catalytic upgrading of lactic acid to fuels and chemicals by dehydration/hydrogenation and C-C coupling reactions, *Green Chemistry*, 11, 1101-1104, (2009). [Top 10 papers of Green Chemistry in August 2009.](#) [Cover article of August 2009 issue of Green Chemistry.](#)
15. C. A. Gaertner, Juan Carlos Serrano-Ruiz, D. J. Braden, J. A. Dumesic. Catalytic upgrading of bio-oils by ketonization, *ChemSusChem*, 2, 1121-1124, (2009).
16. E. Gurbuz, E. L. Kunkes, D. A. Simonetti, R. M. West, Juan Carlos Serrano-Ruiz, C. A. Gaertner, J. A. Dumesic. Catalytic production and upgrading of biomass derived monofunctional hydrocarbons, *Conference Proceedings - 2009 AIChE Annual Meeting*, 09AIChE, (2009).
17. D. A. Simonetti, E. L. Kunkes, R. M. West, Juan Carlos Serrano-Ruiz, C. A. Gaertner, J. A. Dumesic. Catalytic conversion of biomass-derived carbohydrates to functional molecules on carbon-supported Pt-Re catalysts, *Conference Proceedings - 2009 AIChE Annual Meeting*, 09AIChE, (2009).
18. Juan Carlos Serrano-Ruiz, J. A. Dumesic. Catalytic upgrading of biomass-derived acids by dehydration/hydrogenation and C-C coupling reactions, *The North American Catalysis Society Conference Proceedings*, NACS Meeting, (2009).
19. Juan Carlos Serrano-Ruiz, R. M. West, J. A. Dumesic. Catalytic conversion of renewable biomass resources to fuels and chemicals, *Annual Review of Chemical and Biomolecular Engineering*, 1, 79-100, (2010).
20. Juan Carlos Serrano-Ruiz, D. Wang, J. A. Dumesic. Catalytic Upgrading of Levulinic Acid to 5-nonanone, *Green Chemistry*, 12, 574-577, (2010).
21. Juan Carlos Serrano-Ruiz, D. J. Braden, R. M. West, J. A. Dumesic. Production of diesel and gasoline hydrocarbon fuels from cellulose via catalytic upgrading of  $\gamma$ -valerolactone, *Preprints - American Chemical Society, Division of Petroleum Chemistry*, 55(1), 134-137, (2010).
22. A. D. Patel, Juan Carlos Serrano-Ruiz, J. A. Dumesic, Robert P. Anex. Techno-economic analysis of 5-nonanone production from levulinic acid, *Chemical Engineering Journal*, 160, 311-321, (2010).
23. D. M. Alonso, J. Q. Bond, Juan Carlos Serrano-Ruiz, J. A. Dumesic. Production of liquid hydrocarbon transportation fuels by oligomerization of biomass-derived C<sub>9</sub> alkenes, *Green Chemistry*, 12, 992-999, (2010). [Top 10 most accessed articles in Green Chemistry Jul-Setp 2010.](#) [Selected as a 2010 Hot Paper by Green Chemistry.](#) [Featured on Highlight in Chemical Science.](#) [Featured on Green Car Congress magazine.](#)

24. Juan Carlos Serrano-Ruiz, D. J. Braden, R. M. West, J. A. Dumesic. Conversion of cellulose to hydrocarbon fuels by progressive removal of oxygen, *Applied Catalysis B: Environmental*, 100, 184-189, (2010). Top 25 Hottest articles in *Applied Catalysis B* from Oct-Dec 2010 and from Jan-March 2011. [Featured on Green Car Congress Magazine.](#) [Featured on Alternative Energy newswire magazine.](#) [Awarded as one of the most cited Applied Catalysis B: Environmental articles.](#)
25. C. A. Gaertner, Juan Carlos Serrano-Ruiz, D. J. Braden, J. A. Dumesic. Ketonization reactions of carboxylic acids and esters over ceria-zirconia as biomass-upgrading processes, *Industrial & Engineering Chemistry Research*, 49, 6027-6033, (2010).
26. Juan Carlos Serrano-Ruiz, J. A. Dumesic. Catalytic routes for the conversion of biomass into liquid hydrocarbon transportation fuels, *Energy and Environmental Science*, 4, 83-99, (2011). [Top 10 most read articles in Energy and Environmental Science in Dec 2010.](#) [Included in a special issue of Energy and Environmental Science dedicated to Biofuels.](#) [Top 25 most read articles in Energy and Environmental Science from Jan to March 2011.](#)
27. F. K. Kabir, A. D. Patel, Juan Carlos Serrano-Ruiz, J. A. Dumesic, R. P. Anex. Techno-economic analysis of Dimethylfuran (DMF) and Hydroxymethylfurfural (HMF) production from pure fructose in catalytic processes, *Chemical Engineering Journal*, 169, 329-338, (2011).
28. H. N. Pham, Y. J. Pagan-Torres, Juan Carlos Serrano-Ruiz, D. Wang, James A. Dumesic, A. K. Datye. Improved hydrothermal stability of niobia-supported Pd catalysts, *Applied Catalysis A: General*, 397, 153-162, (2011).
29. K. V. Kumar, H. Souza, Juan Carlos Serrano-Ruiz, V. Gupta. A site energy distribution function for Sips isotherm by condensation approximation method and its application to the characterization of porous materials. *Journal of Chemical & Engineering Data*, 56, 2218-2224, (2011).
30. Juan Carlos Serrano-Ruiz, R. Luque, A. Sepúlveda-Escribano. Transformation of biomass-derived platform molecules: from high-added value chemicals to fuels via aqueous-phase processing, *Chemical Society Reviews*, 40, 5266-5281, (2011). [Featured on Wiley Journal ChemInform.](#)
31. E.V. Ramos-Fernández, J. Ruiz-Martinez, J. Silvestre-Albero, Juan Carlos Serrano-Ruiz, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso. Effect of the support, Al<sub>2</sub>O<sub>3</sub> or SiO<sub>2</sub>, on the catalytic behaviour of Cr-ZnO promoted Pt catalysts in the selective hydrogenation of cinnamaldehyde. *Applied Catalysis A: General*, 402, 50-58, (2011).
32. F. Rajabi, S. Nourian, S. Ghiassian, A. M. Balu, M. R. Saidi, Juan Carlos Serrano-Ruiz, R. Luque. Heterogeneously catalysed Strecker-type reactions using supported Co (II) catalysts: microwave vs. conventional heating. *Green Chemistry*, 13, 3282-3289, (2011). [Featured on Wiley Journal ChemInform.](#)
33. Juan Carlos Serrano-Ruiz, R. Luque. Biocombustibles líquidos: procesos y tecnologías, *Anales de la Real Sociedad Española de Química*, 4, 383-389, (2011).
34. A. Gonçalves, J. Silvestre-Albero, E. V Ramos-Fernández, Juan Carlos Serrano-Ruiz, J. Órfão, A. Sepúlveda-Escribano, M. Pereira. Highly dispersed ceria on activated carbon for the catalyzed ozonation of organic pollutants, *Applied Catalysis B: Environmental*, 113-114, 308-317, (2012).
35. Juan Carlos Serrano-Ruiz, E. V Ramos-Fernández, A. Sepúlveda-Escribano. From biodiesel and bioethanol to liquid hydrocarbon fuels: new hydrotreating and advanced microbial technologies, *Energy and Environmental Science*, 5, 5638-5652, (2012). [Featured as a key scientific article on Renewable Energy Global Innovations.](#)
36. M. Catalina, J. Cot, A. M. Balu, Juan Carlos Serrano-Ruiz, R. Luque. Tailor-made biopolymers from leather waste valorization, *Green Chemistry*, 14, 308-312, (2012). [Selected as a Hot paper by Green Chemistry.](#)
37. Juan Carlos Serrano-Ruiz, J. M. Campelo, R. Luque, A. A. Romero. Biofuels as Suitable Replacement for Fossil Fuels, *Green Chemistry for Environmental Remediation*, Eds. R. Sanghi and V. Singh, John Wiley & Sons, Inc., Hoboken, NJ, USA. doi: 10.1002/9781118287705.ch15, (2012).
38. R. Luque, A. M. Balu, J. M. Campelo, M. Dolores Gracia, E. Losada, A. Pineda, A. Angel Romero, Juan Carlos Serrano-Ruiz. Catalytic applications of mesoporous silica-based materials, *Catalysis*, Eds: J. J Spivey, M. Gupta, Y.-F. Han, RSC Publishing, Cambridge, UK. doi: 10.1039/9781849734776-00253, (2012).
39. Juan Carlos Serrano-Ruiz, A. Pineda, A. M. Balu, R. Luque, J. M. Campelo, A. A. Romero, J.M. Ramos-Fernández. Catalytic transformations of biomass-derived acids into advanced biofuels, *Catalysis Today*, 195, 162-168, (2012).

40. A. Pineda, A. M. Balu, J. M. Campelo, R. Luque, A. A. Romero, Juan Carlos Serrano-Ruiz. High activities of ball-milled synthesized low-load supported iron oxide nanoparticles on mesoporous aluminosilicates in alkylation reactions. *Catalysis Today*, 187, 65-69, (2012).
41. R. Luque, A. Pineda, J. M. Campelo, J. C. Colmenares, A. A. Romero, Juan Carlos Serrano-Ruiz. Carbonaceous residues from biomass gasification: a novel approach from waste valorisation to valuable products, *Journal of Natural Gas Chemistry*, 21, 246-250, (2012).
42. Juan Carlos Serrano-Ruiz, James A. Dumesic. Catalytic production of liquid hydrocarbon transportation fuels, *Catalysis for Alternative Energy Generation*, Ed. László Guzzi A. Erdohelyi, Springer (New York). doi: 10.1007/978-1-4614-0344-9\_2, (2012).
43. Juan Carlos Serrano-Ruiz, R. Luque, J. Clark. The role of catalysis in the biorefinery of the future, *The Role of Catalysis for the Sustainable Production of Biofuels and Biochemicals*, Ed. K. Triantafyllidis, A. Lappas, M. Stöcker, Elsevier. (2012).
44. Juan Carlos Serrano-Ruiz, R. Luque. [Editorial Hot Topic: New Biotechnologies for Biofuels and Advanced Chemicals Production](#), *Current Chemical Biology*, 6, 1-1, (2012).
45. Juan Carlos Serrano-Ruiz, R. Luque, J. M. Campelo, A. A. Romero. Continuous-flow processes in heterogeneously catalysed transformations of biomass derivatives into fuels and chemicals, *Challenges*, 3(2), 114-132, (2012). [Free access paper \(published 12 July 2012\), 4500 downloads as for Dec 2015.](#)
46. A. Carrillo, E. Serrano, Juan Carlos Serrano-Ruiz, R. Luque, J. García Martínez. Helical Al-and Ce-MCM-41 materials as novel catalyst for acid and redox processes, *Applied Catalysis A: General*, 435-436, 1-9, (2012).
47. Juan Carlos Serrano-Ruiz, J. M. Campelo, M. Francavilla, A. A. Romero, R. Luque, C. Menéndez-Vázquez, A. B. García, E. J. García Suárez. Efficient microwave-assisted production of furfural from C5 sugars in aqueous media catalysed by Brønsted acidic ionic liquids, *Catalysis Science and Technology*, 2, 1828-1832, (2012).
48. F. Rajabi, R. Luque, Juan Carlos Serrano-Ruiz. Efficient room temperature O-silylation of alcohols using a SBA-15 supported cobalt(II) nanocatalyst, *Chemistry & Biodiversity*, 9, 1823-1828, (2012).
49. R. Buitrago; J. Ruiz-Martínez; Juan Carlos Serrano-Ruiz; F. Rodríguez-Reinoso, A. Sepúlveda-Escribano, Ethanol steam reforming on Ni/Al<sub>2</sub>O<sub>3</sub> catalysts. Effect of the addition of Zn and Pt, *Journal of Colloid & Interface Science*, 383, 148-154 (2012).
50. V. Gómez, A. M. Balu, Juan Carlos Serrano-Ruiz, S. Irusta, D. D. Dionysiou, R. Luque, J. Santamaría, Microwave-assisted mild-temperature preparation of neodymium-doped titania for the improved photodegradation of water contaminants, *Applied Catalysis A: General*, 441-442, 47-53 (2012).
51. R. Buitrago, Juan Carlos Serrano-Ruiz, A. Sepúlveda-Escribano, F. Rodríguez-Reinoso, J.A. Dumesic. Ce promoted Pd-Nb catalysts for  $\gamma$ -valerolactone ring-opening and hydrogenation, *Green Chemistry*, 14, 3318-3324, (2012).
52. Juan Carlos Serrano-Ruiz, J. Faria, M. P. Ruiz-Ramiro. Biological Feedstocks for Biofuels, *An Introduction to Green Chemistry Methods*, 116-130, doi:10.4155/ebo.13.333, (2013).
53. A. de Lucas-Consuegra, N. Gutiérrez-Guerra, A. Caravaca, Juan Carlos Serrano-Ruiz, J. L. Valverde. Coupling catalysis and electrocatalysis for hydrogen production in a solid electrolyte membrane reactor, *Applied Catalysis A: General*, 483, 25-30, (2014).
54. A de Lucas-Consuegra, N. Gutiérrez-Guerra, J. L. Endrino, Juan Carlos Serrano-Ruiz, J. L. Valverde. Direct production of flexible H<sub>2</sub>/CO synthesis gas in a solid electrolyte membrane reactor, *Journal of Solid State Electrochemistry*, 1-9, (2015).
55. N. Gutiérrez-Guerra, M. Jiménez-Vázquez, Juan Carlos Serrano-Ruiz, J. L. Valverde, A. de Lucas-Consuegra. Electrochemical reforming vs. catalytic reforming of ethanol: A process energy analysis for hydrogen production, *Chemical Engineering and Processing: Process Intensification*, 95, 9-16, (2015).
56. N. Gutiérrez-Guerra, J. Gutierrez-Cobos, Juan Carlos Serrano-Ruiz, J. L. Valverde, A. de Lucas-Consuegra. Electrochemical activation of Ni catalysts with potassium ionic conductors for CO<sub>2</sub> hydrogenation, *Topics in Catalysis*, 58, 1256-1269, (2015).

57. N. Gutiérrez-Guerra, L. Moreno-Lopez, Juan Carlos Serrano-Ruiz, J. L. Valverde. Gas phase electrocatalytic conversion of CO<sub>2</sub> to syn-fuels on Cu based catalysts-electrodes. *Applied Catalysis B: Environmental*, 188, 272-282, (2016).

## Patents:

1. James A. Dumesic; Juan Carlos Serrano-Ruiz; Ryan M. West, *Catalytic conversion of cellulose to liquid hydrocarbon fuels by progressive removal of oxygen to facilitate separation processes and achieve high selectivities*, [U.S. Patent US2010324310A1](#), [Licensed by Wisconsin Alumni Research Foundation \(WARE\)](#).
2. International PCT patent request WO2015/166129 “Tubo reactor de reformado con vapor de agua”.
3. National patent, “*Procedimiento de obtención de metanol a partir de CO<sub>2</sub> y sistema electroquímico para realizarlo*” under revision.
4. National patent, “*Dispositivo electroquímico para el reformado de alcoholes*”, under revision.

## Participation in funded research projects:

I have participated in more than 20 national and international research projects, several of them as a Principal Investigator (detailed below):

Title: Development of new catalysts for the conversion of biomass into hydrogen and liquid hydrocarbon fuels. Principal Investigator Juan Carlos Serrano-Ruiz.  
Entity: Emerging Projects, University of Alicante, Spain (GRE10-30), 2011-2013.

Title: Desoxygenation of bioliquids derived from biomass liquefaction. Principal Investigator JCSR.  
Entity: Petrowood Limited, Portugal.

Title: Cascatbel. Principal Investigator JCSR.  
Entity: European Commission, FP7.

Title: Valor Plus. Principal Investigator JCSR.  
Entity: European Commission, FP7.

Title: Sun to Liquids. Principal Investigator JCSR.  
Entity: European Commission, H2020.

Title: Solpart. Principal Investigator JCSR.  
Entity: European Commission, H2020.

## Other merits:

- **Editor of the books:**
  1. “[Production of liquid hydrocarbon fuels from biomass](#)” from Taylor y Francis.
  2. “[New Biotechnologies for Increased Energy Security: The Future of Fuel](#)” from CRC Press.
  3. “[New Microbial Technologies for Advanced Biofuels: Toward More Sustainable Production Methods](#)” from CRC Press.
  4. “[Advanced Biofuels: Using Catalytic Routes for the Conversion of Biomass Platform Molecules](#)” from CRC Press.
- 5 years of experience as a regular reviewer of international scientific journals on Biofuels, Catalysis and Green Chemistry such as Energy and Environmental Science, Green Chemistry, Biofuels Bioproducts and Biorefining, ChemSusChem, Angewandte Chemie International Edition, Chemical Society Reviews, Applied Catalysis B: Environmental, Journal of Catalysis, Environmental Progress and Sustainable Energy, RSC Advances, Catalysis Science & Technology, Catalysis Communications, Journal of Molecular Catalysis A and Carbon. **More than 35 papers reviewed in 2011. I have also reviewed the book “Handbook of Biofuels: processes and technologies” for the Chemistry World magazine.**
- Freelance Scientific Editor from 2011-2012
- Invited conferences: 1) *Catalytic production of liquid biofuels from biomass-derived molecules*. University-Institute of Materials, Alicante, Spain 2011. 2) *Main technologies for the industrial production of liquid biofuels from biomass*. University Miguel-Hernández, Elche, Spain, 2011. 3) Aqueous-phase processing of biomass-derivatives to advanced biofuels, Neste Oil, Porvoo, Finland, 2012. 4) Catalytic routes to fuels and chemicals from biomass, Aalto University, Helsinki, Finland, 2012. 5) Plenary lecture “From biomass to

advanced biofuels: Alternatives to biodiesel and bioethanol via catalytic conversion”, Catalysis for Renewable Sources, Lund, Sweden, 2013.

- Lecturer of the subject “*Biofuels*” as a part of the Master on Solar and Renewable Energies, University of Elche, Spain, Terms 2010-present.
- Lecturing tasks in doctoral course *Advances in Biorefineries of International Doctoral Programme in Bioproducts Technology PaPSaT*, Aalto University, Finland, May, 2012.
- Member of the Editorial Board of “[The Scientific World Journal](#)”.