

ANSWER TO THE REVIEWERS

Manuscript ID:	coatings-2055675
Title:	Mitigation of Urban Heat Island Effects by Thermochromic asphalt pavement
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1. Initial Considerations

Dear Editor,

We would like to acknowledge the engagement with this manuscript and efforts to send us the reviewers' comments, which are really valuable. Actually, we tried to answer each comment carefully.

All authors would like to thank both reviewers for their thorough examination of the manuscript and valuable comments, which have undoubtedly contributed to improve the overall quality of the work.

This letter serves as a guide to identify all the changes the authors have introduced into the reviewed version of the manuscript, to take into account the pertinent criticisms and suggestions from the reviewers. In each case, (i) the Reviewer's comment / question is presented first, (ii) the authors' reply/answer is given next, and, finally, (iii) the action prompted by the reply is described. Moreover, the most relevant changes in the manuscript are shaded marked up using the "Track Changes" in the file "Revised_Manuscript_coatings-2055675".

We look forward to hearing from the Editor,

Orlando Lima Jr.

2. Specific Answers to the Reviewers' Comments

TO REVIEWER #2

Concerning REVIEWER #2 remarks, the following changes were introduced in the manuscript, or alternatively additional clarifications are made:

Comment 1: Abstract:

"Road pavement are usually dark and, consequently, have a low albedo", it is important to emphasize that asphalt based pavement, the situation is different for cement based pavement.

Answer: The authors appreciate the effort and all the comments from reviewer 2. Actually, the authors were discussing about the asphalt pavements. Thus, this aspect was considered by the authors being more specific.

Action: In abstract (Line 18-22), the text was rewritten as following: "Asphalt road pavements are usually dark and, consequently, have a low albedo. Therefore, they absorb energy as heat, increasing the Urban Heat Island (UHI) effect, which impacts the environment, energy consumption, and human health. Through the functionalization with thermochromic materials (TM), this work aims to develop a smart asphalt pavement able to change its surface color, increasing the reflectance, and thus mitigate this phenomenon."

Note: the line number considers the track changes accepted.

Comment 2: 1. Introduction

The subject of this paper is the development of thermochromic microcapsules to reduce heat absorption in pavements and mitigate the urban heat island effect, therefore it should focus on the introduction of the urban heat island effect, mitigation measures, and the application of microcapsules in pavements, rather than a single introduction of color-changing microcapsules in other fields, although thermochromic microcapsules are a new functional material, there are still relevant research articles on asphalt pavements that require literature citation by the authors.

Answer: Since the theme is novel for asphalt pavements, the authors have explained several aspects in the introduction, such as: Urban heat island definition, mitigation measures, existing studies towards cool pavements, mechanism of working of the thermochromic material (thermocapsules), and the potential application of thermochromic materials in road engineering for UHI mitigation. However, regarding the kind observation of the reviewer, the authors have improved and restructured the introduction focusing on the urban heat island effect, mitigation measures, and the application of microcapsules in pavements and relevant research articles on asphalt pavements were added.

Action: All introduction (Page 1, 2, and 3) was rewritten considering the reviewer's recommendations: most focused on the introduction of the urban heat island effect, mitigation measures, application of microcapsules in pavements, rather than a single introduction of color-changing microcapsules in other fields. In addition, relevant research works were cited in this concern.

Comment 3: 1. Introduction

It is worth mentioning that there are eight paragraphs in the frontier section, which is inappropriate.

Answer: The authors appreciate the recommendation. We agree with the reviewer. The introduction (Page 1, 2, and 3) was all rewritten and restructured as mentioned in the previous answer. Now it contains 5 paragraphs.

Action: All introduction was rewritten considering the reviewer's recommendations.

Comment 4: 1. Introduction

Over-citation of literature, 35 literatures are cited for this section!

Answer: The authors agree with the reviewer. This section was reduced focusing on the most important topics kindly recommended by the reviewer.

Action: Action: The introduction (Page 1, 2, and 3) was rewritten as per the reviewer's recommendations: some over-citations and paragraphs were removed as well as new relevant research works were added. Thus, the number of citations was reduced to 30.

Comment 5: 2. Materials and Methods

The materials and methods in this section are disorganized. It is suggested to subdivide this section into Materials, Sample preparation, Test methods (1...2...3...), and the experimental equipment and conditions are described in detail.

Answer: The authors appreciate the recommendation. The materials and Methods was reorganized as Materials, Sample preparation, Test methods the experimental equipment and conditions.

Action: The materials and methods was reorganized as:

2.1. Materials (line 111)

2.2. Sample Preparation (115)

2.3. Test Methods, Experimental Equipment, and Conditions (line 133)

Note: the line number considers the track changes accepted.

Comment 6: 3. Results and Discussion

Although the test results are analyzed and discussed in this section, it is suggested that the title of test method and illustrations should emphasize the test object. For example, the object of FTIR test should be solution or asphalt mortar, and the object of SEM and EDS test should be solution or asphalt mixture or aggregate? (The full text needs to be carefully examined for similar issues)

Answer: The title of each test was rewritten considering the test method and the substrate that received the functionalization in order to avoid any misunderstanding.

Action: The titles of the tests were renamed in order to make it clearer which bituminous substrate received a layer of functionalization: whether it was the asphalt binder, or whether it was the asphalt mixture, as follows:

3.1. Fourier Transform Infrared Spectroscopy on Asphalt Binder (line 201)

3.2. Thermal Differential on Asphalt Binder (line 240)

3.3. Scanning Electron Microscopy and Energy-Dispersive X-ray Spectrometer on Asphalt Mixture (line 266)

3.4. Quick Ultraviolet Accelerated Weathering Test and Colorimetry on Asphalt Mixture (line 313)

3.5. Accelerated Polishing Test on Asphalt Mixture (line 341)

Note: the line number considers the track changes accepted.

Comment 7: 4. Conclusions

This section is too burdensome, and it is worth noting that you do not need to write as many conclusions as you do experiments.

Answer: The authors thank the reviewer. The conclusions section was rewritten considering the recommendations.

Action: Rewrite the entire conclusion more briefly (Page 12). Only the essential information is presented.

Comment 8: 4. Conclusions

For the research article, your fifth conclusion is fatal, which is a comprehensive negation of your work. You need to carefully choose the appropriate language to elaborate your conclusion, and put the deficiencies in the research into the prospect.

Answer: The authors have reviewed the manuscript, considering the language. In addition, the fifth conclusion has been rewritten in a non-detrimental form to this work; this aspect is included in future work, considering the limitations of this research work.

Action: Improvement of the writing of the conclusion (page 12), removal of the fatal passage in the fifth conclusion, which is already covered in the suggestions for future work (line 401-403).

Note: the line number considers the track changes accepted.

Yours sincerely,

Orlando Lima Jr. (the corresponding author)

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